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An Analysis of the interventions to improve the geographic distribution of physicians in OECD countries

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RÉSUMÉ

Un déséquilibre dans la répartition géographique des médecins a été observé dans la plupart des pays membres de l'OCDE. Le nombre de médecins praticiens, par rapport à la densité de population générale, est nettement plus faible dans les régions rurales et éloignées que dans les zones urbaines. Plusieurs interventions ont été mises en œuvre pour tenter de corriger le déséquilibre, mais les rapports indiquent que les solutions durables n'ont pas été identifiées. L'objectif de cette étude est de comprendre la persistance d'une pénurie de médecins dans les régions rurales, malgré la mise en œuvre des interventions. Deux approches évaluatives fondées sur la théorie sont utilisées pour évaluer la pertinence et la plausibilité des interventions. Une analyse stratégique permet de hiérarchiser les causes des pénuries de médecins et de classer les interventions en fonction de leur capacité à cibler ces causes. Une analyse logique permet d'évaluer le fondement théorique des interventions afin de déterminer si les interventions peuvent atteindre leurs résultats escomptés. Les résultats de cette recherche démontrent que les interventions mises en œuvre dans les pays de l'OCDE pour réduire la pénurie de médecins sont conçues pour cibler les causes du problème et sont donc pertinentes pour la répartition géographique des médecins. Les résultats démontrent également qu'à l'exception des stratégies réglementaires, selon les théories de la motivation au travail, les interventions peuvent inciter les médecins à choisir une pratique médicale rurale. La persistance d'une pénurie de médecins dans les régions rurales n'est pas due à la faiblesse théorique des interventions. D'autres recherches sont nécessaires pour évaluer le processus de production et la mise en œuvre des interventions.

Mots clés : pénuries de médecins; répartition géographique; choix de lieu de pratique; régions rurales et éloignées; pays de l'OCDE; modèles logiques; analyse stratégique; évaluation des interventions

ABSTRACT

An imbalance in the geographic distribution of physicians has been observed in most member countries of the Organisation for Economic Cooperation and Development (OECD). The number of practicing physicians in relation to the general population density is significantly lower in rural and remote regions than in urban areas. Several interventions have been implemented across the OECD in an attempt to rectify the geographic maldistribution of physicians; reports indicate, however, that sustainable solutions have not been identified. The purpose of this study is to understand the persistence of physician shortages in rural regions of OECD countries, despite the implementation of interventions. To accomplish this goal, two theory-based evaluative approaches are used to evaluate the relevance and the plausibility of interventions. A strategic analysis allows for the prioritization of the causes of physician shortages, and the ranking of the interventions based on their ability to target these causes. A logic analysis allows for the evaluation of the theoretical foundation of the interventions, in order to determine whether the interventions can achieve their intended outcome. The results of this research demonstrate that the interventions implemented in OECD countries to reduce physician shortages are designed to target the causes of the problem and are therefore relevant to the geographic maldistribution of physicians. Results also demonstrate that with the exception of regulatory strategies, and according to the theories of work motivation, the interventions can plausibly encourage physicians to choose rural medical practice. This research demonstrates that the persistence of physician shortages in rural regions is not due to the theoretical weakness of the interventions. Further research to evaluate the production process and the implementation of the interventions is required to more fully explain the persistence of physician shortages in rural regions.

Keywords: physician shortages, geographic maldistribution, choice of practice location, determinants, rural and remote regions, OECD countries, strategies, interventions

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To my family; the only reason why I wrote this.

CHAPTER 1: Introduction

An imbalance in the geographic distribution of physicians has been observed in several countries in the developed world. The Organisation for Economic Cooperation and Development (OECD) reports that all but one of 34 member countries have raised concern that physicians are unevenly distributed among geographic territories (Ono, Schoenstein, & Buchan, 2014). The number of working physicians in relation to the general population density varies from one geographic area to another, enough to signal a problem. The observed trend is that physicians tend to concentrate in urban and economically advantaged areas, leaving rural regions experiencing shortages that are sometimes severe (OECD, 2010; Pond & McPake, 2006).

Although the definition of what constitutes a "rural" region varies, it is agreed that these are smaller-sized communities with lower population densities that tend to be widely dispersed (Manusov, Livingston, Stine, & Van Durme, 2010; Martinez, Pampalon, Hamel, & Raymond, 2004; OECD, 2010; Ono et al., 2014; H. K. Rabinowitz, Diamond, Markham, & Wortman, 2008). Most rural regions are also physically distant from urban centres, or from "metropolitan influence zones," defined as areas where inhabitants are still able to commute to urban centres for work (OECD, 2010; Ono et al., 2014; Pong & Pitblado, 2005; Simoens & Hurst, 2006). Rural regions are sometimes additionally characterized as remote, which means that they may be difficult to access from urban areas due to a lack of transport infrastructure or harsh climates (OECD, 2010; Ono et al., 2014; World Health Organization, 2010). While low population density and distance from urban areas are the two commonly held definitions of rurality, it has also been noted that the socioeconomic status of inhabitants tends to decrease as the distance

from urban centres increases, so that socioeconomic disadvantage is also a shared characteristic among many rural areas (Martinez et al., 2004; OECD, 2010; Ono et al., 2014; Sibley & Weiner, 2011; World Health Organization, 2010). One of the ways in which this disadvantage is manifest is in the inequitable geographic distribution of physicians, which leads to a shortage of essential health services in rural regions (CIHI, 2006; Laurent, 2002; Martinez et al., 2004).

Physician shortages in rural regions means that the people living in these areas face more difficulty accessing necessary health care services than their urban counterparts, leaving them essentially *underserviced* in terms of what is seen as a fundamental human right (Grobler et al., 2009). Rural residents have fewer choices, if any, in terms of physicians, which means they may not receive the most suitable health care for their needs; the lack of competition among health providers may lead to suboptimal service provision (OECD, 2010). Rural populations are reported to have worse health status and higher demand for health services due to their particular socioeconomic conditions (Ono et al., 2014). Rural inhabitants experience higher death rates due to traumas, traffic accidents and suicides, and they exhibit higher rates of smoking, alcohol consumption and obesity (Martinez et al., 2004). An inequitable access to health services in rural regions is linked to lower scores in standardized mortality, life expectancy at birth, infant mortality, health perception and functional health (CIHI, 2006). On the other hand, a greater number of physicians per capita is associated with better overall health outcomes and is inversely associated with avoidable mortality (Simoens & Hurst, 2006). A shortage of physicians is recognized as an impediment to the achievement of improved health status and overall health equity, especially for disadvantaged populations (Dussault & Franceschini, 2006; World Health Organization, 2010).

1.1 Problem description

Due to the central role occupied by the physician in improving the delivery of and access to essential health services by disadvantaged populations, OECD member countries have devised various interventions to attempt to mitigate the shortage of physicians in rural regions (Dussault & Dubois, 2003; Kabene, Orchard, Howard, Soriano, & Leduc, 2006; Ono et al., 2014). However, reports by the Organisation for Economic Cooperation and Development (OECD) and the World Health Organization (WHO) suggest that no single strategy has been identified that offers a sustainable solution to the shortages of physicians in rural areas (Ono et al., 2014; World Health Organization, 2010). This is not due to a lack of interest in the topic. There is an abundance of literature addressing the problem and possible solutions, ranging from policy papers, to government and international agency documents, to peer-reviewed studies (L. Chen et al., 2004; Dumont, Zurn, Church, & Thi, 2008; Grobler et al., 2009; H. K. Rabinowitz, Diamond, & Markham, 1999; Sibley & Weiner, 2011; World Health Organization, 2010). Some of the literature proposes one kind of approach to the problem, like economic programs or educational reforms (Bloor & Maynard, 2003; Curran, Bornstein, Jong, & Fleet, 2004). Others document a range of interventions that have been implemented in certain countries or territories (Fournier, Contandriopoulos, Diene, & Trottier, 2004; J. Humphreys, Wakerman, & Wells, 2007). Yet another range of literature examines why physicians prefer to practice in certain geographical areas and not others (Bilodeau, Leduc, & van Schendel, 2006; Dussault & Franceschini, 2006; Laurence, Willisamson, Sumner, & Fleming, 2010; Lu, Hakes, Bai, Tolhurst, & Dickinson, 2008; H.K. Rabinowitz, Diamond, Veloski, & Gayle, 2000). Additionally, a number of

evaluation studies have been published in recent years to attempt to systematically review or assess the effectiveness of interventions that have already been implemented (Barnighausen & Bloom, 2009; Buykx, Humphreys, Wakerman, & Pashen, 2010; Grobler et al., 2009; H. K. Rabinowitz et al., 2008; Sempowski, 2004; Wakerman et al., 2008).

Throughout these sources, two main critiques are levelled at the interventions to improve the geographic distribution of physicians that researchers suggest may explain the persistence of physician shortages in rural regions of OECD countries. The first is that interventions do not account for the causes of physician shortages in rural regions. Studies suggest that policymakers rarely make reference to the determinants of physician practice location, so that interventions do not match the reasons why physicians may or may not practice in a given location (Buykx et al., 2010; Dolea, Stormont, & Braichet, 2010; Wilson, Couper, & De Vries, 2009; World Health Organization, 2010). The second critique highlights the lack of a theoretical foundation behind interventions to improve the geographic distribution of physicians (Dolea et al., 2010; Dussault & Dubois, 2003; Dussault & Franceschini, 2006; Lehmann, Dieleman, & Martineau, 2008; Ono et al., 2014; Wilson et al., 2009; World Health Organization, 2010). A report by the OECD suggests that interventions are designed and implemented with little or no recourse to scientific evidence (Ono et al., 2014). Other publications have called for a critical examination of the theoretical basis of interventions, to explain how they are supposed to work (L. Chen et al., 2004; Dieleman, Kane, Zwanikken, & Gerresten, 2011; Dussault & Dubois, 2003; J. Humphreys, Wakerman, & Wells, 2008; Lehmann et al., 2008; Wakerman et al., 2008; Wilson et al., 2009).

In the following chapter, a literature review details the interventions that have been implemented in OECD countries with the aim of increasing the number of physicians practicing in rural and remote regions experiencing physician shortages. In chapter 3, the conceptual framework and the objectives of this research are introduced. Chapter 4 presents the methodology used in this study, while chapter 5 details the results of this research in the form of three separate articles. Finally, a discussion of this research and policy implications are found in chapter 6, while chapter 7 presents the conclusion of this study.

CHAPTER 2: Literature review

This chapter presents a review of the literature on interventions that have been implemented across OECD countries to reduce the shortage of physicians in rural regions. The objective of this chapter is to critically review current research on the interventions and to present evidence of their effectiveness and documented shortcomings.

2.1 Article 1: A critical review of the interventions to reduce physician shortages in rural regions of OECD countries

Alya Danish, Régis Blais and François Champagne

Abstract

An imbalance in the geographic distribution of physicians has been observed in most member countries of the Organisation for Economic Cooperation and Development (OECD). Several interventions have been implemented across the OECD in an attempt to rectify the geographic maldistribution of physicians; however, reports indicate that sustainable solutions have not been identified. The purpose of this study is to review current research on the interventions to reduce physician shortages in rural regions and to present evidence of the effectiveness, and the shortcomings, of each intervention. This research demonstrates that there are ten different intervention strategies to reduce physician shortages. Positive outcomes are reported from interventions that combine several strategies simultaneously. However, most of the interventions are not well-documented in a way that allows for the evaluation of effectiveness. The functioning mechanism of interventions has not been adequately studied, so how and why the interventions might rectify the geographic imbalances in physician services is

not understood. A theory-based evaluation is a useful approach to determine whether the interventions are designed in a way that can achieve their intended result.

2.1.1 Introduction

An imbalance in the geographic distribution of physicians has been observed in several countries in the developed world. The OECD reports that all but one of 34 member countries have raised concern that physicians are unevenly distributed among geographic territories (Ono et al., 2014). The number of working physicians in relation to the general population density varies enough from one geographic area to another to signal a problem. The observed trend is that physicians tend to concentrate in urban and economically advantaged areas, leaving rural regions experiencing shortages that are sometimes severe (OECD, 2010; Pond & McPake, 2006). Due to the central role occupied by the physician in improving the delivery of and access to essential health services by disadvantaged populations, OECD member countries have devised various interventions to attempt to mitigate the shortage of physicians in rural regions (Dussault & Dubois, 2003; Kabene et al., 2006; Ono et al., 2014). However, reports by the OECD and the World Health Organization (WHO) suggest that no single strategy has been identified that offers a sustainable solution to the shortages of physicians in rural areas (Ono et al., 2014; World Health Organization, 2010).

2.1.2 Problem description

Physician shortages in rural regions means that the people living in these areas face more difficulty accessing necessary health care services than their urban counterparts, leaving them

essentially *underserviced* in terms of what is seen as a fundamental human right (Grobler et al., 2009). Rural residents have fewer choices, if any, in terms of physicians, which means they may not receive the most suitable health care for their needs, and the lack of competition among health providers may lead to suboptimal service provision (OECD, 2010). Rural populations are reported to have worse health status and higher demand for health services due to their particular socioeconomic conditions (Ono et al., 2014). Rural inhabitants experience higher death rates due to traumas, traffic accidents and suicides, and exhibit higher rates of smoking, alcohol consumption and obesity (Martinez et al., 2004). An inequitable access to health services in rural regions is linked to lower scores in standardized mortality, life expectancy at birth, infant mortality, health perception and functional health (CIHI, 2006). On the other hand, a greater number of physicians per capita is associated with better overall health outcomes and is inversely associated with avoidable mortality (Simoens & Hurst, 2006). A shortage of physicians is recognized as an impediment to the achievement of improved health status and overall health equity, especially for disadvantaged populations (Dussault & Franceschini, 2006; World Health Organization, 2010).

In response, most OECD member countries employ a range of intervention strategies in an attempt to reduce physician shortages in rural regions. However, reports by the OECD and the WHO suggest that no single strategy has been identified that offers a sustainable solution to the shortages of physicians in rural areas (Ono et al., 2014; World Health Organization, 2010).

2.1.3 Objectives

The objective of this article is to critically review current research on the interventions to reduce the shortages of physicians in rural and remote regions of OECD countries; it will also present evidence of the effectiveness and documented shortcomings of each intervention.

2.1.4 Research methods

A critical review of the literature on interventions to improve the geographic distribution of physicians in OECD countries is completed. Publications are initially selected from the OECD and WHO publication databases, from which a number of large-scale systematic reviews on the interventions to improve the geographic distribution of physicians are identified. From there, a snowballing of citations leads to additional sources of information on interventions, as well as a number of evaluation studies of these interventions. Relevant grey literature was included since interventions are often documented in country reports and government publications.

A second line of inquiry was then established through a review of MEDLINE. Keywords used for this search include: “interventions/strategies/programs,” “improve/increase/recruit/retain,” “physicians/healthcare workers/healthcare personnel,” “geographic,” “distribution/shortage,” and “rural/remote/isolated/underserved/underserviced.” Only studies published between January 1995 and December 2014 were searched. Publication language was limited to English and French.

2.1.5 Results

Interventions to increase the number of practicing physicians in rural regions vary in scope and in depth, but all OECD countries employ some form of intervention. Most of these fall under four broad categories: regulatory, financial, educational and tailored interventions (Ono et al., 2014; Simoens & Hurst, 2006; World Health Organization, 2010). The interventions are sub-categorized into ten different strategies, which are described in Table 1.

Table 1: A description of the interventions to reduce physician shortages in rural regions

	Description
Regulatory Interventions	
Trickle-down economics	Oversupplying the market with physicians
Coercive measures	Restricting or mandating location of medical practice
Financial Interventions	
Target medical students	Monetary incentives in return for rural practice
Target practicing physicians	Monetary rewards and incentives for rural practice
Educational Interventions	
Selective admission policies	Recruiting medical students of rural origin, experience or interest
Curriculum changes	Rural content, rotations, internships or specialties
Rural medical schools	Establishing campuses or training sites in rural regions
Tailored Interventions	
Community support	Mobilizing community members and services to assist local physicians
Professional support	Facilitating professional collaboration and development
Non-traditional health services delivery	Outreach clinics and telehealth initiatives

Regulatory Interventions

Regulatory interventions aim to centrally control the geographical distribution of physicians. There are two common approaches to accomplishing this. The first involves increasing the number of students entering medical training, with the belief that an increase in the overall number of physicians will have a "trickle-down" effect that will lead to an increase in the number of physicians practicing in underserviced regions. The second strategy involves placing restrictions on the number of employment positions available in locations that are deemed to be "oversupplied" or mandating employment in locations that are "undersupplied."

First Strategy: The case for trickle-down economics

Health workforce planning models in OECD countries are a means to achieve a balance between the supply and demand for physicians, in order to ensure adequate access to healthcare services, which is particularly important given the time and cost involved in training new physicians, and the urgency of addressing the needs of aging populations and the increasing burden of chronic diseases (Ono, Lafortune, & Schoenstein, 2013). All OECD countries control the number of students entering into medical training; there are three reasons behind this approach: first, to select the most able applicants, second, to control the costs related to the effects of induced demand, and third, to control the costs of medical education, which is publicly funded to a large extent in most OECD countries (OECD, 2008). Health workforce planning models assess the absolute number of physicians in relation to population density, and based on this assessment, forecast future demand for physician services (Ono et al., 2014). The supply of physicians is controlled mainly through the "inflow" into medical education, while the "outflow"

is taken into consideration by assessing retirement rates, and in some countries like Japan, Australia, and Germany, pre-retirement attrition rates (Ono et al., 2013).

In most OECD countries, policy decisions limiting the number of students entering medical education are made at the government level, whereas in some cases, such as in Ireland, Australia, Germany, and the UK, caps are left at the discretion of medical schools (OECD, 2008; Ono et al., 2013; Ono et al., 2014). Limits may also be placed on the choice of entry into postgraduate medical training—otherwise referred to as residency training or specialization—such as in Canada, France, and the Netherlands (Ono et al., 2014). Only the Czech Republic and the US do not limit student intake into medical training, though in the US, residency places are capped (Ono et al., 2014).

Overall enrolments into medical schools in most OECD countries were reported to have increased at the turn of the last century due to widespread physician shortages (Dauphinee, 2006; OECD, 2008). In Canada, a task force was created in 1998 to examine the shortage of physicians in certain regions of the country, which led to the decision to increase medical student enrolments (Dumont et al., 2008). Between the 1990s and 2007, Canada, along with the UK, France, and Australia, doubled medical school enrolments; this was accomplished, in some instances, by opening new medical schools (OECD, 2008).

Increasing the number of students entering medical education and training is seen as the first step in increasing potential physician supply to underserviced regions (Kirch, Henderson, & Dill, 2012). The rationale behind this strategy, and the argument put forth especially by US

health economists, is that increasing the overall number of physicians will increase competition for patients, driving a more even geographic distribution of physicians whose numbers would trickle down to traditionally underserviced areas where the market is not yet saturated, and where physicians can earn more profit (Matsumoto et al., 2010).

An opposing argument is that classic economic principles cannot be applied to the healthcare system, which is characterized by market failures due to a number of characteristics including information asymmetry, the presence of externalities in the form of licensing and regulation, and wage negotiations making the price of physician services unresponsive to changing supply and demand (Bloor & Maynard, 2003; Zurn, Dal Poz, Stilwell, & Adams, 2004). One observed consequence of increasing the overall supply of physicians is supplier-induced demand, in which physicians over-treat patients in order to increase their wages, and patients over-utilize services as a result of limited knowledge (Bloor & Maynard, 2003; OECD, 2008). Another reported consequence is that physicians continue to concentrate in areas of wealth and social advantage rather than dispersing geographically according to population health needs (Bourgeuil, Mousquès, & Tajahmadi, 2006; Matsumoto et al., 2010). Experts agree that despite a steady increase in the overall number of physicians over the past few decades, an optimal geographic distribution has not been achieved, and physician shortages in rural regions have persisted (Bourgeuil et al., 2006; Matsumoto et al., 2010; OECD, 2008).

Health workforce planning models have faced an increasing level of criticism due to their inability to account for the dynamics of the healthcare workforce, including existing labour shortages, or for the factors driving population health needs, such as service utilization patterns,

delivery models, and epidemiological variables (Dumont et al., 2008; OECD, 2008; Ono et al., 2013). Planning physician workforce supply in federal states such as Switzerland, Germany, the United States, Australia, and Canada is particularly problematic, because collaboration and coordination among the various jurisdictions is necessary for a streamlined management of physician numbers among regional territories, and because there is the added challenge of competition between regions to attract and retain physicians (Dumont et al., 2008). In addition, a lack of coordination between stakeholders such as health ministries, finance, education, and workforce planning is an important cause of inadequate physician supply planning (OECD, 2008). Needs-based and outcomes-directed health workforce planning, which accounts for broader contextual influences on the healthcare system, is thus recommended (Dumont et al., 2008; Ono et al., 2013).

Second Strategy: Coercive measures

In what are often described as "coercive" interventions, governments, medical councils or professional bodies restrict or direct physicians to areas where they are needed rather than having them voluntarily choose to establish a practice in rural and remote regions (Ono et al., 2014; Pong & Russell, 2003; Wilson et al., 2009; Zurn et al., 2004). Although the majority of OECD countries are increasingly abandoning such strategies, many countries place limitations on where physicians can practice at certain points in their careers (Ono et al., 2014; Simoens & Hurst, 2006). For example, in some jurisdictions, Australian physicians who have not yet completed a residency program may only provide services if they first work in a rural or remote area for a

number of years (Dunbabin, McEwin, & Cameron, 2006; Frehywot, Mullan, Payne, & Ross, 2010; Simoens & Hurst, 2006).

In Canada, some provinces place restrictions on granting billing numbers, which are used to obtain government reimbursement for health services provided (Pong & Russell, 2003). Until the early 2000s, British Columbia, Quebec, Nova Scotia and New Brunswick all had restrictions on billing numbers, so that only areas of shortage were "open" to new clinicians (Ono et al., 2014; Pong & Russell, 2003; Simoens & Hurst, 2006). Both British Columbia and Nova Scotia eventually abandoned this approach because it was deemed unconstitutional, while in New Brunswick, billing number restrictions are used to a much lesser extent than in previous decades (Dumont et al., 2008; Pong & Russell, 2003; Simoens & Hurst, 2006). In Quebec, the "Regional Plan for Medical Manpower" establishes quotas for the number of available positions for new physicians by region (Dumont et al., 2008). New physicians who set up practice in areas of oversupply are penalized by having their fees reduced (Pong & Russell, 2003). This policy has raised concerns regarding a physician's right to choose practice location and has been said to drive physicians away to other provinces (Bourgeuil et al., 2006; Dumont et al., 2008; Pong & Russell, 2003).

Similar interventions are used in Austria, Germany, the Czech Republic, and Denmark, where regional limitations are placed on the allocation of social insurance or provider numbers for the reimbursement of medical acts (Ono et al., 2014; Simoens & Hurst, 2006). In Finland and in the UK, vacancies for new physicians vary by region, while Slovenia, Norway, Denmark and Germany place some restriction on the choice of practice location (Ono et al., 2014). In Norway,

medical graduates are obligated to practice for 18 months in a rural region in order to obtain a medical licence, and no "buy-out" option is provided (Frehywot et al., 2010). In Germany, these restrictions have led to fewer students entering medicine as a profession, while no improvement in the geographic distribution of physicians has been observed (Bourgeuil et al., 2006. Some physicians have opted out of the public system altogether, and practice exclusively under private insurance, billing patients directly {Ono, 2014 #359).

Legislation restricting the choice of practice location may clash with constitutional rights in many OECD countries, and has been criticized for alienating people from the medical profession and from rural practice, and for difficulties in administration and enforcement (Dieleman et al., 2011; Dolea et al., 2010; Dussault & Franceschini, 2006; Grobler et al., 2009; Ono et al., 2014; Wilson et al., 2009). Yet, such measures are efficient in placing medical graduates in underserviced areas in the short term (Grobler et al., 2009; Ono et al., 2014; Wilson et al., 2009). The advantage of coercive mechanisms is the relatively low cost to the healthcare system, but evidence is lacking regarding the effectiveness of these interventions, and the evidence that does exist points to their failure to secure long-term staffing in underserviced regions (Grobler et al., 2009; Ono et al., 2014; Wilson et al., 2009). Overall, evidence suggests that schemes designed to discourage physicians from practicing in oversupplied areas have not improved the geographic distribution of physicians (Bourgeuil et al., 2006).

Financial Interventions

Financial interventions are the most commonly implemented public measure aimed at improving the geographic distribution of physicians by attracting and recruiting them to underserviced rural and remote regions, and by attempting to retain them for as long as possible within these regions (Bourgeuil et al., 2006; Buykx et al., 2010; Pong & Russell, 2003; Sempowski, 2004). As of 2014, the OECD reports that 21 out of the 34 member countries have reported employing financial interventions to foster a better geographic distribution of physicians (Ono et al., 2014). Financial interventions can take the form of incentives offered to medical students or residents, or incentives offered to already practicing physicians, in exchange for practicing in rural and remote regions experiencing physician shortages (Barnighausen & Bloom, 2009; Grobler et al., 2009; World Health Organization, 2010).

First Strategy: Targeting medical students

Referred to as "bonded service agreements" or "return of service agreements," these financial interventions offer bursaries, scholarships, tuition, or loan repayments to medical students in exchange for a commitment to practice in an underserviced region for a specified amount of time. Some programs require medical students to commit to rural service early on in the course of their medical education, offering direct financial compensation at the beginning of enrolment in a program, and simultaneously offering a "buy-out" option that requires recipients to repay the funds received with interest, or pay financial penalties, if they end up backing out of the agreement after graduation (Barnighausen & Bloom, 2009; Sempowski, 2004). Other programs offer loan repayment at the end of a period of service to those who will practice in underserved regions upon completion of their education (Barnighausen & Bloom, 2009).

In Canada, the provinces of Quebec, British Columbia, Alberta, Saskatchewan, Manitoba, Ontario and New Brunswick offer bursaries to medical students in return for practicing medicine in an underserviced region for a fixed amount of time, usually ranging from a few months to three years (Fournier et al., 2004). Ontario's Underserviced Area Program (UAP) is an example of such a program, aimed at mitigating physician shortages in rural and remote regions of Northern Ontario. The UAP offers a return-of-service agreement of up to CAD 10,000 per year to cover tuition expenses of medical students in exchange for practicing medicine in an underserviced community after graduation, for a duration equivalent to the number of years of tuition reimbursed (Barnighausen & Bloom, 2009; Fournier et al., 2004; Sempowski, 2004). Reports indicate that over 70% of graduates are fulfilling their obligation to practice in rural regions (Ono et al., 2014). The Rural Physician Action Plan in Alberta similarly offers full tuition reimbursement on a yearly basis for medical students in return for three years of medical service in a rural community, pro-rated to the number of years the bursary is awarded (Sempowski, 2004).

In the US, state and federal programs have been initiated to improve the supply of physicians in underserved areas, such as the National Health Service Corps (NHSC) and the Area Health Education Centers (Felix, Shepherd, & Stewart, 2003). The NHSC offers loan repayment schemes in exchange for service, with up to USD 28,500 granted per student, per year (Barnighausen & Bloom, 2009; Simoens & Hurst, 2006). The NHSC is reported to have placed over 30,000 physicians in underserviced regions (Barnighausen & Bloom, 2009; Felix et al., 2003).

In Australia, the Rural Incentives Program offers financial incentives to undergraduate medical students and family doctors who agree to practice in areas of shortage (Viscomi, Larkins, & Gupta, 2013). As of 2006, approximately 100 Medical Rural Bonded Scholarships were awarded each year, and a further 246 places were made available yearly to medical students, in exchange for six years of service in rural areas after postgraduate training (Dunbabin et al., 2006). In New South Wales (NSW), the Department of Health developed the Rural Resident Medical Officer Cadetship Program, which also offers bonded scholarships providing financial support for students during the final two years of their medical degree, in return for completing two postgraduate years in a NSW rural hospital (Dunbabin et al., 2006).

Similar programs are reported in Norway and in Japan, where medical students who have taken out loans for their education are exempt from reimbursing them if they work in a rural or underserviced area for a number of years (Simoens & Hurst, 2006).

Some studies have shown that financial incentives in the form of bonded scholarships for medical students have a positive influence on their intention to remain in rural areas (Dolea et al., 2010; J. Rourke, 2008; Viscomi et al., 2013). A longitudinal study across Australia and New Zealand demonstrated that medical students were most likely to practice in rural areas if they participated in bonded service agreements, and that these interventions were effective in increasing the percentage of physicians practicing in rural areas in the short term (Viscomi et al., 2013). While participants in financial intervention programs may not remain in their original placement site, they were more likely than non-participants to work in underserved areas in the

long run (Barnighausen & Bloom, 2009). On the other hand, reports of medical students choosing to buy their way out of rural service commitments have been documented in Canada and in other OECD countries (Simoens & Hurst, 2006; World Health Organization, 2010). A number of US studies also reported substantial losses with over 3 out of 10 participants in financial intervention programs backing out of their commitment to practice in rural and remote regions (Barnighausen & Bloom, 2009). Financial losses are also incurred when incentives are offered to those who would have practiced in rural areas anyway (Ono et al., 2014). Observed differences between participants and non-participants in return-of-service agreements may also be due to selection bias, so the proportion of students who would have taken up work in underserved areas had they not been offered financial incentives is not known (Barnighausen & Bloom, 2009; Bilodeau et al., 2006).

Evaluating the effectiveness of financial interventions is difficult because physicians tend to receive several different types of financial incentives at once, combined with a number of other types of incentives to practice in rural areas (Ono et al., 2014). Most evaluation studies of financial interventions are from the US, where private financing for medical education is more prevalent than it is in most OECD countries, which affects the success of financial interventions and the response of physicians to them (Ono et al., 2014; Wilson et al., 2009). The applicability of the findings from these studies to other countries is not well understood (Barnighausen & Bloom, 2009; Wilson et al., 2009). Overall, the success of return-of-service agreements has varied across OECD countries, and further investigation into their long-term benefit is required (Grobler et al., 2009; World Health Organization, 2010).

Second Strategy: Targeting practicing physicians

Physicians who choose to practice medicine in rural or remote regions can receive a range of financial incentives, such as: assistance to relocate; increased remuneration and various assistance in kind, such as payments for professional development; travel; financing of telemedicine and group practice or professional networks (Bourgeuil et al., 2006).

In the Canadian provinces of Quebec, British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, New Brunswick, and Newfoundland and Labrador, recruitment premiums are offered to physicians who have made the decision to practice in an underserviced region, and additional bonuses are granted to help them relocate and set up practice (Fournier et al., 2004). Ontario's Underserviced Area Program (UAP) offers financial incentives such as relocation grants of up to CAD 40,000 over four years to physicians to set up practice in northern Ontario, a retention premium of CAD 7,000 for every year practiced in the region, and a grant of CAD 2,500 per year for continuing medical education (Barnighausen & Bloom, 2009). Physicians are also offered the option to receive a salary instead of fee-for-service payments if they are located in a low-volume region of northern Ontario (Barnighausen & Bloom, 2009; Pong & Russell, 2003).

Quebec, British Columbia and Alberta offer a "retention" bonus, which is granted for every year of practice in an underserviced region (Fournier et al., 2004). In Alberta, this bonus can reach up to CAD 10,000 for physicians who have been practicing in rural areas for 26 years or more, while Ontario offers yearly premiums of up to CAD 120,000 for practicing in underserviced areas (Ono et al., 2014). Physicians who practice in isolated regions in Quebec,

British Columbia and Alberta are eligible for a "Northern and Isolation Allowance" in the form of additional yearly premiums that can range from CAD 6,000 to 30,000 (Fournier et al., 2004; Ono et al., 2014). Additional incentives are offered by most provinces, including compensation reflecting the frequency of on-call and the breadth of practice, and hourly premiums for overnight and weekend work (Fournier et al., 2004; Pong & Russell, 2003). Per diems are also offered for physicians to hire locums for holidays and other instances of absence, which can range from CAD 510 in Nova Scotia to CAD 1,200 in the Northwest Territories (Ono et al., 2014).

Most Canadian provinces provide differentiated salaries for physicians practicing in rural areas (Fournier et al., 2004; Simoens & Hurst, 2006). Quebec relies predominantly on this financial intervention, providing some of the highest differentials for rural physicians, who receive up to 115% of the Medicare basic fee (Fournier et al., 2004; Simoens & Hurst, 2006). In British Columbia and Manitoba, physicians are paid up to 40% higher salaries depending on the region of practice, the number of years in practice, and whether they are employed or own a private practice, while in both British Columbia and Ontario, the application of salary caps beyond a pre-established limit is lifted for rural physicians (Fournier et al., 2004).

In France, a guaranteed annual income of EUR 55,000 is offered to physicians setting up practice in an underserved region for the first time; Denmark offers similar guarantees for regions of shortage (Ono et al., 2014). Austria, the UK, Australia, and the US offer financial support for the relocation and initial setup costs of practices in rural areas (Simoens & Hurst, 2006). In Germany, rural physicians receive a one-time payment ranging from EUR 15,000 to

EUR 60,000 depending on the types of services provided and the degree of rurality of the region; experienced rural GPs are eligible for EUR 1,500 per quarter to continue to work in the underserviced area (Ono et al., 2014). A similar arrangement exists in Denmark, where rural physicians over the age of 63 are dissuaded from retirement through premiums of over DKK 1,000,000 per year they continue to practice, and the hiring of support nurses and other staff is paid for by regional governments (Ono et al., 2014).

Australia, New Zealand, the US, and the UK offer targeted payments to support locum programs and on-call duties, while costs incurred for attending conferences, skills development programs and continuing education activities are fully reimbursed for physicians practicing in underserviced areas in Australia as part of the National Rural Health Strategy (Fournier, 2001; Kearns, Myers, Adair, Coster, & Coster, 2006; Simoens & Hurst, 2006).

In the United Kingdom, physicians receive higher capitation payments for patients from underserviced areas (Simoens & Hurst, 2006). Pay increases for physicians were implemented in order to reduce turnover in underserviced areas; this did increase the number of physicians in the short term, but it was deemed inefficient by a cost-benefit analysis, due in part to a 2.5% decrease in physician productivity subsequent to the removal of on-call responsibilities (Bourgeuil et al., 2006; OECD, 2008; Ono et al., 2014). A national audit review concluded that physician shortages persisted in the most deprived areas of England and Wales (Bourgeuil et al., 2006; Ono et al., 2014).

Studies of US financial incentive programs have concluded that these interventions have been successful in recruiting a large number of physicians to underserved areas (Barnighausen & Bloom, 2009; Pathman, Konrad, Dann, & Koch, 2004; Porterfield et al., 2003; Sempowski, 2004). Pathman et al.'s (2004) study of 468 primary care physicians found that those with return-of-service commitments were more likely to practice rurally in comparison to those without. In Canada, the availability of financial incentives was positively correlated with the recruitment of physicians to rural practice, while increasing compensation for rural medical service and reducing it for oversupplied areas was reportedly successful in altering the overall geographic distribution of family physicians in the short term (Viscomi et al., 2013; Wilson et al., 2009).

Several studies demonstrate that financial incentives for practicing physicians have a positive influence on the intention to remain in rural areas (Dolea et al., 2010; J. Rourke, 2008; Viscomi et al., 2013). Reasons cited by family physicians for remaining in rural practice beyond their return-of-service agreement include cash incentives, tuition repayment, paid accommodation and paid vacation (Viscomi et al., 2013). A study of 69 financial incentive programs in the US found that physicians who were obligated to rural practice also stayed in those areas longer (J. Rourke, 2008). Other reviews of financial interventions suggest that they are only effective for the duration of service agreements (Bourgeuil et al., 2006; Buykx et al., 2010; Sempowski, 2004; Wilson et al., 2009). Although participants in financial intervention programs may not remain in their original placement site, they are more likely than non-participants to work in underserved areas in the long run (Barnighausen & Bloom, 2009).

Some argue that physicians expect to receive comparatively better compensation for practicing in underserviced regions, and that financial incentives are an important form of institutional recognition of the challenging nature of rural and remote medicine (Bilodeau et al., 2006). While evidence suggests that financial interventions may affect physician supply in underserved areas, it does not allow for strong causal inferences (Barnighausen & Bloom, 2009; Wilson et al., 2009). A definitive pronunciation regarding the effectiveness of financial interventions in optimizing the geographic distribution of physicians is not possible due to the variability of study results and the methodological limitations involved with evaluation studies (Grobler et al., 2009; OECD, 2008; Ono et al., 2014; World Health Organization, 2010).

Educational Interventions

Educational interventions are made up of three main strategies that can be implemented separately or in combination. The first strategy involves targeting students of rural origin, experience, or interest for recruitment and admission into medical schools. The second strategy involves exposing students already in urban medical schools to rural practice by offering rural medical curricula, rotations, internships, or specialty streams. The third strategy involves distributing medical education to rural areas by setting up medical school campuses or training institutions dedicated to rural medicine on location.

First Strategy: Selective admissions policies

The first strategy of educational intervention involves selecting the "right" students, those with rural backgrounds, through targeted admission policies. The concept of the "rural pipeline" posits that a physician's choice of practice location is a complex and lifelong process, so policies aiming to increase the number of physicians in rural areas must start by targeting would-be physicians, and continue to intervene throughout their careers to encourage their retention to areas of shortage (Crump, Barnett, & Fricker, 2004; Curran et al., 2004). Studies from Canada demonstrate that the profile of Canadian medical students differs considerably from the general population, and even more so than that of the rural population (Curran et al., 2004; Pong & Pitblado, 2005). Medical students are more likely to come from families of higher socioeconomic status, whereas rural students are more likely to come from lower income families (Dhalla, Kwong, & Streiner, 2002; World Health Organization, 2010). Evidence suggests that the medical profession does not attract sufficient rural students, and that they are generally underrepresented in the medical profession, in part because rural students often do not consider medicine as a career possibility, or are not academically prepared for admission (Curran et al., 2004). Rural areas sometimes have lower-level secondary education, which prohibits these students from considering a career in medicine or for qualifying for admission (Pong & Heng, 2005; World Health Organization, 2010). Therefore, some medical schools in OECD countries have adopted "affirmative" type recruitment and admission policies (Pong & Heng, 2005; World Health Organization, 2010). Preferential status is granted to rural students and to those expressing interest in practicing medicine in rural areas (Curran et al., 2004; H. K. Rabinowitz, Diamond, Markham, & Santana, 2011).

In the United States, programs such as the Alabama Rural Health Leaders Pipeline Program prepares and supports students from underserved rural communities, and those of minority backgrounds, to pursue health professions by pairing them with career counselors who help them develop the academic and social skills necessary for a career in medicine (Curran et al., 2004; Pong & Heng, 2005). In Missouri and in Michigan, medical schools waive the MCATs requirement and have lower GPA requirements for premedical students attending rural colleges or enrolled in a rural health track (Crump et al., 2004). The Physician Shortage Area Program (PSAP) at Jefferson Medical College of Thomas Jefferson University in Pennsylvania actively recruits and selectively admits applicants who have grown up in a rural area and who are committed to practicing family medicine in rural areas (H. K. Rabinowitz et al., 2011). Reports demonstrate that two-thirds of the graduates from the PSAP were still practicing in rural areas after 11–16 years (Grobler et al., 2009; Wilson et al., 2009).

In Canada, the University of Manitoba's Northern Medical Unit (NMU) targets Aboriginal students and encourages them to pursue a career in medicine by offering academic support through tutorials in premedical subjects, while the Northern Ontario School of Medicine (NOSM) recruits students from northern, rural or remote, aboriginal, or francophone backgrounds (Curran et al., 2004; Pong & Heng, 2005).

Similarly, in a scheme offered by the Australian government, medical school applicants have an increased chance of admission in return for working in a shortage area for a period equal to the length of medical training; some medical schools specifically target Aboriginal students, Torres Strait Islanders and students from the Northern Territories based on a regional quota

system (Wilson et al., 2009). In Japan, medical schools in each of 47 geographic regions select local students based on a quota system catering to the region's unique needs, and offer a variety of incentives to encourage suitable students to pursue a career in rural medicine (Ono et al., 2014). Scotland has a similar strategy where students from rural high schools are encouraged to study medicine through a range of funding and educational programs (Ono et al., 2014). Studies have shown that these types of initiatives have been successful in recruiting and retaining rural physicians for extended periods of time (Ono et al., 2014; H. K. Rabinowitz et al., 2011; Simoens & Hurst, 2006; World Health Organization, 2010).

Second Strategy: Curriculum changes for medical students

The second type of educational intervention involves exposing students who are already studying medicine to rural medical practice by implementing curriculum changes or offering internships, rotations, or rural-based specialties. This approach is more costly than the first component and requires an upfront investment, but is commonly regarded as one of the most effective in exposing medical students to rural medicine and cultivating their interest in the specialty (Curran et al., 2004; Ono et al., 2014). Due to the broad skill set required for rural medicine, obtaining hands-on experience through internships and rotations reportedly offers an exceptional generalist learning environment for all students (Grobler et al., 2009; World Health Organization, 2010). Through forging contacts with other professionals in rural communities, learning to cope with professional isolation, and developing rural community leadership skills, students become better prepared to practice medicine in a variety of settings (Grobler et al., 2009). Without this type of exposure, urban medical students are sometimes unable to transfer

their knowledge and skills to regions where advanced technology, tools and specialized support are unavailable (World Health Organization, 2010).

(Pong & Heng, 2005) report that all Canadian medical schools offer undergraduate medical education opportunities in rural settings that last between 2 and 4 weeks, and at least 12 rural family medicine residency programs offer hands-on skill development and greater procedural competence to prepare students for rural medical practice. The Northeastern Stream Residency Program (NESR) and the Northeastern Ontario Postgraduate Specialty (NOPS) Program in Ontario also offer postgraduate rural rotations for residents in anesthesia, general surgery, internal medicine, pediatrics and psychiatry. A similar graduate-level program with a rural focus offered by the Northern Family Medicine Education Program (NorFaM) in Labrador has demonstrated that the longer the exposure to a rural setting, the more likely a physician will choose to remain in rural practice (Pong & Heng, 2005).

Australian medical schools mandate eight weeks of rural experience as part of the medical curriculum (Simoens & Hurst, 2006). Almost 25% of students do at least half of their clinical training in rural satellite campuses of their universities (Dunbabin et al., 2006).

In the US, the PSAP of Pennsylvania requires third-year family medicine students to undergo their clerkship in a rural location and their senior internship in family medicine in a rural area (H. K. Rabinowitz et al., 2011). The University of Washington in Seattle offers a community-based family medicine program that trains physicians through a network of rotations in the states of Alaska, Idaho, Montana, and Wyoming, which are predominantly rural.

Evaluations of this program suggest that 83% of graduates subsequently opt for rural family medicine practice (Curran et al., 2004; Pong & Heng, 2005).

Similar examples exist in European countries. Greece mandates two years of practice in a rural area after obtaining a medical degree (Simoens & Hurst, 2006). In Scotland, a "rural track" is offered as part of General Practice training, and additional fellowships are offered to those willing to work in rural and remote areas (Ono et al., 2014). The UK exposes students to rural medical practice and allows them to gain specialized knowledge and skills facilitating rural practice through the General Practitioner Vocational Training Scheme (Simoens & Hurst, 2006).

Third Strategy: Bringing medical education to rural regions

The third type of educational intervention involves placing medical schools in underserviced rural regions (World Health Organization, 2010). In Canada, a number of satellite campuses and clinical training sites have been established in rural regions. The NOSM has a mandate of social accountability to provide health care services to Northern Ontario (Curran et al., 2004; Pong & Heng, 2005). Students are distributed among two campuses and 70 teaching and research sites across Northern Ontario (Ono et al., 2014). Similar initiatives are offered across Canadian universities, such as the University of British Columbia, which has a satellite campus in Prince George, and the Université de Montréal, which has a satellite campus in the rural region of the Mauricie.

Other OECD countries reserve a quota for students of northern origin, such as at Norway's University of Tromso, which was established in northern Norway in 1972. Research has shown that the majority of graduates subsequently remain in northern Norway, and are more likely to do so if they are of northern origin (Ono et al., 2014). Japan's Jichi Medical University was established specifically to train physicians for areas of shortage, and it recruits rural students while offering them a variety of loan and incentive programs. Studies have shown that over 70% of students fulfill the obligation to practice in their home region, and if they do not, they are likely to practice in other rural areas (Ono et al., 2014).

Other examples from the United States include the University of Alabama, which grants early admission to students willing to move to Tuscaloosa—a rural university town—to study rural health, and the School of Medicine in Indianapolis, Indiana, which grants early admission and a tuition waiver in exchange for studying rural health in Terre Haute, a rural area (Crump et al., 2004).

A study on the University of Louisville, Kentucky's school of medicine demonstrates how a satellite campus established in 1993 in a town of 20,000 people resulted in a stronger experiential component to medical education by minimizing "urban disruption," thereby fostering a sense of continuity and a more positive experience of rural practice for medical students (Crump et al., 2004). The study reported that the decision to move to or stay in a rural area was strongly associated with personal and social factors, and that developing and maintaining an affinity between an individual and their community was an important factor in retention.

Studies demonstrate that medical school graduates tend to practice where their educational experience has taken place (Pong & Heng, 2005). Locating medical training in areas of shortage is the most costly strategy in educational interventions since it requires an investment in infrastructure (Ono et al., 2014). The evidence suggests, however, that they are also the most effective. Medical training in rural regions, away from the traditional setup of urban, tertiary care hospitals, is beneficial in retaining more physicians to rural regions, but also benefits the region itself by contributing to overall infrastructure development (Ono et al., 2014; World Health Organization, 2010). Although this aspect has not been adequately studied, there is emerging evidence regarding the importance of this type of a social accountability framework for medical education (World Health Organization, 2010). Evidence from Australia, Canada and the US demonstrates that a medical education tailored to community needs, where research, training and partnerships are established between medical schools and local health systems, results in a deeper sense of place and commitment on the part of medical students to the local areas, which is in turn associated with a greater retention in rural practice (Crump et al., 2004; World Health Organization, 2010).

Tailored Interventions

This category includes a wide range of interventions that are designed specifically according to the unique needs of each region. Community support may be offered to the physicians and their families through initiatives to facilitate spousal employment, childcare, and assistance with housing, or by offering community-oriented activities to help with the integration

into the new region. Professional support aims to ameliorate working conditions in the region and address the work-related needs of the physician. Finally, non-traditional healthcare service delivery attempts to bypass the need for more physicians altogether.

There are few studies documenting these types of interventions, but most critical reviews of interventions to address physician shortages have stressed the importance of tailored interventions and the need to further explore and evaluate them (Bourgeuil et al., 2006; Buykx et al., 2010; Grobler et al., 2009; Ono et al., 2014; Simoens & Hurst, 2006; Wilson et al., 2009; World Health Organization, 2010). According to the literature, while support measures encourage rural practice and are the most valued by physicians, they are also the least frequently implemented (Dolea et al., 2010; Grobler et al., 2009).

First strategy: Community Support

Some OECD countries have devised measures to encourage collaboration and coordination between physicians and community members in rural areas, in order to facilitate integration and to assist spouses in finding employment (OECD, 2008). In what are sometimes referred to as "golden hellos," community mobilization activities are set up to build rapport between new physicians and key community leaders (Bourgeuil et al., 2006; Dieleman et al., 2011). One example is the Robert Wood Johnson Foundation's Southern Rural Access Program (SRAP), which uses a targeted regional approach to help rural communities assess their health needs and recruit physicians (Felix et al., 2003). Evaluations of this approach in Mississippi and in Arkansas demonstrated that addressing community factors through holistic development

activities, including the mobilization of community members, building relationships between local health providers and residents, providing technical assistance to enhance local capacities, and teambuilding to develop community strategic plans, may increase the retention of physicians to rural regions (Felix et al., 2003).

In Australia, support measures are widely used with the aim of improving physicians' health and well-being through community resources (Wakerman et al., 2008). This is done by offering social and emotional support by linking physicians to community support networks and distributing information regarding the new community; by providing regular health check-ups, crisis plans, and an emergency support line; and by organizing rural retreats (Dieleman et al., 2011). Studies of this approach showed a reduction of the intention to leave the rural region on the part of physicians in comparison to before the implementation of the program, as well as an increase in the utilization of the offered support activities, and of physicians reporting having other people with whom to discuss professional and personal issues; there was also a reduction in the number of physicians reporting physical and mental health problems compared to before the intervention (Dieleman et al., 2011).

Second strategy: Professional Support

Some OECD countries have devised measures to encourage collaboration and coordination between health professionals in rural areas and facilitate professional development (OECD, 2008). The importance of establishing group practices and professional networks as a strategy to mitigate physician shortages in rural regions has been stressed in several studies,

despite the scarcity of supportive empirical evidence (Buykx et al., 2010; Dieleman et al., 2011; Ono et al., 2014; World Health Organization, 2010). In France, Germany, Canada and Switzerland, new physicians are increasingly opting to work in group practices and community health centers in rural regions, which allow better overall working conditions and higher work satisfaction than solo practices (Ono et al., 2014).

Professional support measures sometimes include the use of multidisciplinary teams composed of non-physician clinicians, such as nurses and physician assistants, to provide healthcare services. Primary healthcare in rural regions requires a broad skill set that many physicians find challenging; for this reason, the inclusion of non-physician clinicians to relieve some of the workload has been recommended (Dubois & Singh, 2009; OECD, 2008; Pong & Russell, 2003). Multidisciplinary teams have been found to facilitate more flexible working patterns allowing more opportunities for leave and reduced on-call duties, which may lead to a reduction in stress, burnout and injury (OECD, 2008; Ono et al., 2014).

Physician assistants have been used extensively in the US, while the potential for using them has been explored in Canada, the UK, Australia, New Zealand and the Netherlands, demonstrating that their skills largely overlap with those of primary care physicians and that they are capable of substituting where there are physician shortages (OECD, 2008). In Slovenia, "model practices" include a family doctor, a graduate nurse, and a junior nurse to ensure some transfer of competence from the physician to the nurses, while in Germany, older patients with reduced mobility can be seen by non-physician clinicians for routine visits (Ono et al., 2014). Task sharing between nurses and doctors has been introduced in minor ways in some OECD

countries; it has been found to improve productivity, but remains a controversial approach among both professions (OECD, 2008; Pong & Russell, 2003). Changes to skill-mix among health professionals have often created tensions, and have been faced with resistance to the extent that very few countries allow non-physicians to be reimbursed directly for the new services they may provide (OECD, 2008). For these reasons, task sharing initiatives intending to relieve physician shortages in rural regions have not been widely implemented.

Third strategy: Non-traditional healthcare services delivery

Outreach services

Outreach services such as traveling clinics attempt to bring healthcare to hard to reach, remote areas and to regions with populations that are geographically dispersed in a way that makes it difficult or costly to set up traditional clinics (OECD, 2010; Pong & Russell, 2003; Wakerman et al., 2008). In Northern Ontario, a Visiting Specialist Clinic Program arranges for specialists to travel to remote regions where the population base cannot support full-time specialists to offer one to three day clinics (Pong & Russell, 2003). A similar arrangement is made in Australia for hard to reach, remote areas, where mobile doctors and other service providers will travel to outlying regions on a scheduled or needs-based approach, in a "Fly in/Fly out" outreach program (Ono et al., 2014; World Health Organization, 2010). This type of approach improves access to service for small communities by increasing occasions of service and workforce length of stay, and are reportedly cost effective (Wakerman et al., 2008).

Telemedicine

Telemedicine allows diagnostic services to physically take place in rural areas where tertiary services are normally not available. Using web services and video conference, case analysis can be performed for rurally-located patients by specialists in urban areas (Dieleman et al., 2011). Many OECD countries are investing in improving broadband capacity, which is unavailable in many rural areas, in order to effectively use advanced technology (OECD, 2010; Ono et al., 2014).

The North Network is an Ontario, Canada initiative that uses telemedicine to provide specialist consultations, continuing medical education, and patient education to rural communities all over the province, through video conferencing (Pong & Russell, 2003). A similar telehealth network of 200 facilities in British Columbia has been shown to improve access to healthcare in rural communities by linking them to specialists in Vancouver (Ono et al., 2014).

In Germany, community nurses in remote rural areas are able to send patient information through a digital platform to a general practitioner in an urban center. Since the beginning of this initiative, over 5000 home visits have been conducted using e-health equipment, with over 1000 participating patients, 40 physicians, and 30 nurses (OECD, 2010). Reports indicate that this intervention is much appreciated by all parties involved and has had a positive impact on German healthcare institutions (OECD, 2010).

In Australia, telehealth has been widely used in the form of virtual clinics and video pharmacy assessments and monitoring. Studies demonstrate that telehealth has improved access to medical records for remote populations, reduced overall on-call hours for local physicians, and increased consultation hours (Wakerman et al., 2008).

Studies of telemedicine suggest that it can be a cost effective approach that helps reduce professional isolation and enhance access to healthcare in rural and remote communities, but definitive empirical evidence is still lacking (Ono et al., 2014; Pong & Russell, 2003). As the remoteness of a region increases and population size and density decreases, more innovative approaches are required, with their success depending on being able to aggregate a critical service population mass that can support a comprehensive and sustainable range of healthcare services (Wakerman et al., 2008).

2.1.6 Analysis

A select number of examples of interventions are identified based on evidence of effectiveness, or of positive outcomes, as reported in published studies. All but two of the examples are from Canada, Australia, or the US. These are presented in Table 2. There are two examples each of financial interventions *targeting medical students*, *targeting practicing physicians*, and employing *selective admission policies*. There are eight examples of successful *curriculum changes*, one example of a promising *community support* initiative, and three examples of positive outcomes subsequent to the implementation of *professional support* measures. There is only one example of each of the non-traditional services delivery

interventions. **Combination programs** are those that employ more than one intervention strategy simultaneously. Evidence of effective combination programs was available from Canada (six examples), Australia (two examples), the US (five examples), Japan (one example) and Norway (one example).

There are four notable combined programs that have shown encouraging outcomes, which have been reported in a number of studies. In Canada, the province of Ontario's Underserviced Area Program recruits medical students directly from rural and underrepresented communities, and has established satellite campuses across rural and remote regions that teach a specialized rural curriculum. This program offers return-of-service agreements for medical students, with undergraduate rural internships, rural family medicine residency streams, and postgraduate rural rotations for specialist physicians (Ono et al., 2014; Pong & Heng, 2005). In addition, rural physicians receive recruitment premiums, relocation grants, retention premiums, and overall higher salaries in Ontario (Pong & Russell, 2003). Outreach services in the form of traveling clinics and a telehealth network have also been set up to provide medical care to difficult to access areas in Northern Ontario (Curran et al., 2004; Ono et al., 2014).

Table 2: Evidence of effectiveness of intervention strategies to reduce physician shortages in rural areas

STRATEGY	COUNTRY	PROGRAM	EVIDENCE OF EFFECTIVENESS
Financial targeting of medical students	Australia	Australia's NSW Rural Resident Cadetship Program (Dolea et al., 2010; Dunbabin et al., 2006; Ono et al., 2014)	43% of participants who enrolled before 1999 were still practicing in rural areas in 2004, compared to 20% of the national average (Ono et al., 2014).
			Reported increase in the percentage of workers practicing in rural areas (Dolea et al., 2010; Dunbabin et al., 2006).
	US	Health Professional Shortage Area (HPSA) program	30,000 primary care physicians placed in rural areas between 1972 and 2009 (Barnighausen & Bloom, 2009; Pathman et al., 2004).
			Financial incentive programs had the highest service completion rates and physician retention rates (Grobler et al., 2009).
			Contractually obligated physicians are more likely to practice in rural regions compared to non-obligated physicians (Ono et al., 2014; Pathman et al., 2004).
Financial targeting of practicing physicians	Canada	Quebec premiums of 25–40% of salary for rural practitioners	Improved distribution of family physicians across rural regions (Fournier, 2001).

	Australia	Financial incentives for long serving rural doctors	Positive changes in the intention to stay in rural areas; 86% of recipients remaining in the rural areas (Dolea et al., 2010).
Selective admission	USA and Canada		Policies are associated with an increase in the number of physicians entering rural practice (Grobler et al., 2009).
	Japan		89% of regional-quota graduates have remained within their region, compared to 54% of normal-entry graduates (Ono et al., 2014).
Curriculum changes	Canada	University of British Columbia, mandatory four-week rural clerkship	Of 194 graduates, 30% were practicing in rural areas two years after finishing residency (Orzanco et al., 2011).
	Canada	Université de Sherbrooke, mandatory and elective rural clerkships	Of 180 graduates, 38% were practicing in rural areas two years after finishing residency (Orzanco et al., 2011).
	Canada	University of Calgary, Alberta	Students with a rural background who also completed a rural family medicine clerkship were 2.5 times more likely to enter rural practice than urban students (Pong & Heng, 2005).
	Canada	Université de Laval, Québec family practice program	42% of program graduates chose practice in rural or underserved communities (Curran et al., 2004).

	Australia		Australian medical graduates are more likely to choose rural placements if they have been exposed to a specialized rural medical education (Viscomi et al., 2013).
	USA		Fellows who completed rural health programs have a higher tendency to locate their practice in rural settings (Acosta, 2000; Wilson et al., 2009).
	USA	Rural Physician Associate Program (RPAP), Minnesota	58.8% of 284 program graduates were found practicing in rural areas (Curran et al., 2004).
	USA	University of Minnesota School of Medicine	41% of program graduates chose practice in rural or underserved communities (Curran et al., 2004).
Community support	USA	Southern Rural Access Program (SRAP) serving in Arkansas	In a two-year period, eight primary care providers recruited to the Arkansas Delta (Felix et al., 2003).
Professional support	Canada		A survey of 1116 rural family physicians showed that 40% identified CME as an issue of concern and 32% felt existing CME initiatives were inadequate (Curran et al., 2004).
	Australia		Two years after the intervention, fewer physicians were considering leaving their post (from 53% to 46%) and fewer intended to leave (from 30% to 25%) (Dieleman et al., 2011; Dolea et al., 2010). Reports from rural physicians of physical problems dropped to 41% from 47%, and reports of mental health problems dropped

			to 37% from 44% before the intervention (Dieleman et al., 2011).
	Australia	University of Queensland, Australia	80% of participants reported positive changes in their intention to stay in rural areas (Dolea et al., 2010; J. Humphreys et al., 2007).
Non-traditional services delivery	Canada	Telehealth network in British Columbia	Reports of improved access to health services for 12 rural communities, and a significant reduction in costs (Ono et al., 2014).
	Australia	Australia FlFO and DIDO services	An increase in the number of rural physicians in Western Australia for the first time since 2008 (Ono et al., 2014).
COMBINED PROGRAMS			
Selective admission *Curriculum changes* *Rural medical schools*	Canada	Northern Ontario School of Medicine	70% of graduates are training in family medicine in rural regions (Ono et al., 2014).
Selective admissions	Canada	Northwestern Ontario Medical Program	Participants in the program were seven times more likely to practice in Northwestern Ontario compared to non-participants (Pong & Heng, 2005).

Curriculum changes			
Selective admission	Canada	Northeastern Ontario Family Medicine Program	Graduates from 1993–2003 represented 64% of all person-years of medical practice in northern Ontario (Pong & Heng, 2005).
Curriculum changes			
Curriculum changes	Canada	Department of Family Medicine, University of British Columbia	A study of graduates between 1981 and 1992 demonstrated that 50% were practicing in isolated rural locations (Curran 2004).
Rural medical schools			
Selective admission	Canada	Memorial University of Newfoundland Medical School	12.6% of 1322 graduates worked in rural Canada and 6.1% worked in rural NL (Mathews, Rourke, & Park, 2008).
Curriculum changes			
Curriculum changes	Canada	Northern Family Medicine Education Program, Memorial University of Newfoundland	91% of graduates were in rural practice at the time of the study (Pong & Heng, 2005).
Rural medical schools			46% of graduates go into rural practice (Curran et al., 2004).
Selective admission	Australia	Parallel Rural Community Curriculum (PRCC) at Flinders University	Program participants reported greater access to patients, clinical learning opportunities in a rural setting, and rural community resources. Participants' academic performance improved compared to tertiary hospital

			peers, and to their own results in previous years (Walters, Worley, & Mugford, 2003; World Health Organization, 2010).
Curriculum changes			
Rural medical schools			Quota students undertook longer rural placements than their non-quota peers, and were 10 times more likely to spend their intern year in a rural region (Wilson et al., 2009).
Selective admission	Australia	University of Queensland School of Medicine	An increase in the number of medical graduates selecting rural internships (Wilkinson, Birks, Davies, Margolis, & Baker, 2004).
Curriculum changes			
Rural medical schools			
Selective admission	USA	University of New Mexico (Curran et al., 2004; Dolea et al., 2010; Grobler et al., 2009).	Primary care curriculum graduates significantly more likely to work in underserved areas than conventional program graduates (Grobler et al., 2009).
Curriculum changes			Program consistently demonstrates a steady increase in the number of graduates recruited to work in rural areas (Dolea et al., 2010).

			12-year follow-up study of 244 graduates showed 35% working in an underserved community (Wayne, Kalishman, Jerabek, Timm, & Cosgrove, 2010).
Selective admission	USA	Jefferson Medical College PSAP	PSAP graduates represent only 1% of all medical graduates in the State of Pennsylvania, but account for 21% of family physicians practicing in rural Pennsylvania (H. K. Rabinowitz et al., 1999).
Curriculum changes			Program consistently demonstrates a steady increase in the number of graduates recruited to work in rural areas (Dolea et al., 2010).
			Two-thirds of graduates continued to practice in the same rural area 11–16 years later (Dolea et al., 2010).
Curriculum changes	USA	University of Washington School of Medicine (UWSOM) (Curran et al., 2004)	21% of alumni practiced in rural communities of less than 10,000 population, while 31% practiced in communities of less than 25,000; 83% of graduates of the rural training track were in rural practice (Pong & Heng, 2005).
Rural medical schools			
Curriculum changes	USA	Montana Family Practice Residency Satellite Program, (UWSOM) (Curran et al., 2004)	69% of surveyed graduates were practicing in rural communities (Curran et al., 2004).
Rural medical schools			

Curriculum changes	USA	Area Health Education Centers of the University of Colorado	13.7% of the graduates of the program established practices in rural regions, compared to 7.8% of their urban counterparts (Curran et al., 2004).
Rural medical schools			
Financial targeting medical students	Japan	Japan's Jichi Medical University	Approximately 70% of program graduates were still practicing in a rural region six years later (Dolea et al., 2010).
Selective admission			Graduates are four times more likely to work in rural areas after contractual obligation (Matsumoto & Inoue, 2008).
Curriculum changes			
Rural medical schools			
Selective admission	Norway	University of Tromso	70% of medical graduates of rural origin, and 20% of medical graduates of urban origin continue to practice in rural Norway after contractual obligation (Ono et al., 2014).
Curriculum changes			
Rural medical schools			

In Australia, the best evidence of effectiveness is from the Parallel Rural Community Curriculum (PRCC) at Flinders University, where students are selectively admitted to medical school based on their rural origin and their stated intent to become rural physicians, and follow a rurally-adapted curriculum in the sparsely populated Northern Territory (Walters et al., 2003; Wilson et al., 2009). Overall, Australia has implemented most of the ten intervention strategies in various locations, but program outcomes have not yet been documented. One example is the Rural Incentives Program, which offers hundreds of bonded scholarships to medical students each year in exchange for medical practice in underserviced regions after graduation (World Health Organization, 2010). Professional support measures such as locum programs, skills development and continuing education specifically targeting rural physicians, in addition to a number of support measures at the community level such as induction and orientation for new physicians, have also been implemented in Australia (Dieleman et al., 2011). Outreach services such as Fly in/Fly out clinics and virtual telehealth clinics help to provide medical services to particularly small and remote communities (Ono et al., 2014). One study reports that in Australia, the proportion of medical students from rural areas has increased from 10% in 1989 to 25% in 2000, due to a combination of strategies targeting incoming medical students (J. Rourke, 2008).

In the United States, Pennsylvania's Physician Shortage Area Program at Jefferson Medical College actively recruits and admits medical students of rural origin and those who are committed to rural medicine from the outset (H. K. Rabinowitz et al., 1999). This program includes an obligatory third-year clerkship, as well as a senior internship, in a rural location. The

University of New Mexico offers a similar program, which is profiled in a number of studies for its positive outcomes (Dolea et al., 2010; Grobler et al., 2009; Wayne et al., 2010).

Finally, Japan's Jichi Medical University combines financial strategies with comprehensive educational intervention, including all three strategies of selective admission, curriculum changes and rural training sites. Medical students are recruited directly from rural regions, and physicians are trained on location in the area of shortage (Matsumoto & Inoue, 2008). A variety of financial incentives are offered, such as exemptions from repaying their loans for medical school tuition. Systematic communication between undergraduates, alumni, and senior role models, a favourable environment fostering assurance and reducing career path anxiety, greater engagement with the community leading to a sense of rootedness, and a cultural emphasis on fulfilling contractual obligations contribute to the success of this program (Dieleman et al., 2011).

2.1.7 Discussion

A critical review of published literature on interventions to improve the geographic distribution of physicians in OECD countries demonstrates that there are ten strategies for intervention within the four broad categories proposed by international agencies (Ono et al., 2014; World Health Organization, 2010). Regulatory interventions include trickle-down economics and coercive measures. Financial interventions can target medical students, or they can target physicians who are already practicing. Most educational interventions use one or more of three identified strategies as part of a "pipeline" approach that aims to intervene early and continuously throughout medical training: selective admissions policies, curriculum changes

and rural medical schools. Tailored interventions also include three approaches to facilitate rural medical practice: community support, professional support, or non-traditional services delivery. The subcategories of the strategies are not mutually exclusive, and many interventions employ a combination of strategies simultaneously.

Programs that have reported the most success are those that implement a combination of strategies. While no single strategy has successfully reduced the shortage of physicians in rural regions, there is some consensus that multidimensional, or "bundled," policies that incorporate a number of intervention strategies simultaneously seem to offer the most promising results in the long term (Buykx et al., 2010; Dolea et al., 2010; OECD, 2008; Ono et al., 2014; Ryan & Deci, 2000; Sempowski, 2004; Wilson et al., 2009; World Health Organization, 2010). It is not clear, however, which particular combination is most effective, and there is no specific template that can be recommended as a solution to physician shortages in rural regions. The general recommendation repeated in many of the studies is that OECD countries should adopt a comprehensive approach that blends strategies related to staffing, infrastructure, workplace organization, the professional environment, and social, family and community support (Buykx et al., 2010; Ono et al., 2014).

Our findings indicated that despite the existence of a number of examples of interventions across OECD countries, few have been adequately documented or evaluated in a way that would allow replication. For this reason, a systematic review published in the Cochrane Library concludes that there are no studies of interventions for increasing the numbers of rural health professionals that are based on controlled trials, before and after studies, or interrupted

time series studies; it also concludes that because interventions are not implemented within the context of well-designed studies, their effects on recruitment and retention cannot be adequately assessed (Grobler et al., 2009). Selection bias—particularly in the form of self-selection into intervention programs—and the presence of confounding factors, especially from the implementation of several intervention strategies at once, limits the validity of evaluations and makes causal inferences impossible (Grobler et al., 2009; Wilson et al., 2009). Most of the literature on interventions is either descriptive in nature or relies mostly on anecdotal evidence; further to that, most of the reviewed studies of financial interventions are from the US, limiting generalizability for other OECD countries with more public healthcare delivery and financing and different remuneration methods for physicians (Barnighausen & Bloom, 2009).

Finally, there is little mention in the literature of the science on which interventions to improve the geographic distribution of physicians have been based. A report published by the OECD asserts that interventions are often designed based on stakeholder beliefs, rather than on sound scientific evidence (Ono et al., 2014). Whether an intervention is well founded, and how it is designed to achieve its intended results, are questions that remain unanswered by the research on physician shortages in rural regions.

2.1.8 Conclusion

Regulatory, financial, educational and tailored interventions to reduce the shortage of physicians in rural regions of OECD countries employ one of or a combination of these ten strategies identified in the literature: trickle-down economic strategies, coercive measures,

financial strategies targeting medical students, financial strategies targeting practicing physicians, selective admission to medical schools, changes to medical curricula, rural medical schools, community support, professional support, and non-traditional health services delivery strategies. However, these interventions have not been adequately documented or evaluated to allow replication. Evaluative research of the interventions to examine their scientific basis is recommended.

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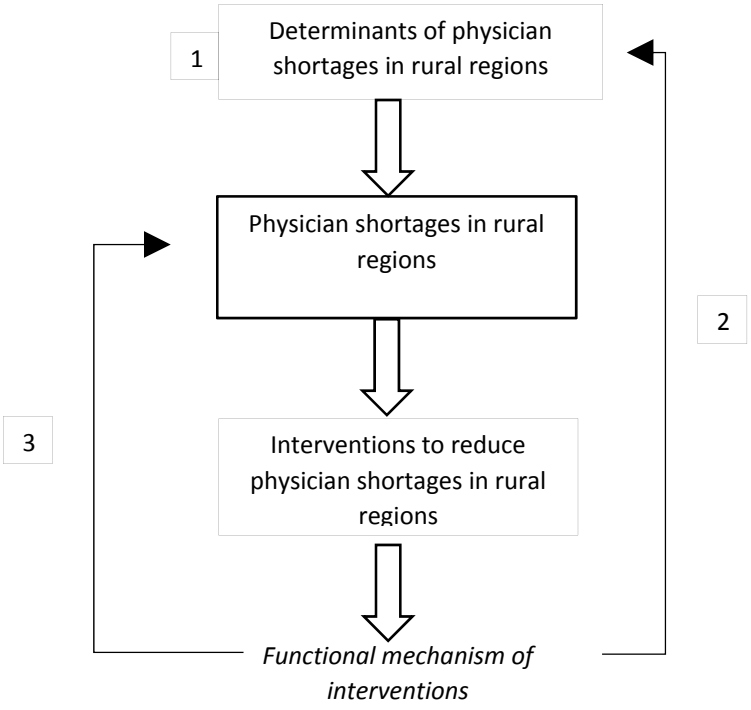
CHAPTER 3: Conceptual framework

The conceptual framework for this study is rooted in an evaluative approach to interventions in the health and social services. In the field of evaluation it is understood that for an intervention to achieve its intended results, it must be designed in a way that responds to the determinants of the problem that needs to be addressed (Brousselle, Champagne, Contandriopoulos, & Hartz, 2011). This criterion is referred to as relevance, or adequacy, and is defined as the appropriateness of the objectives of the intervention "in relation to the socioeconomic problems it is intended to address" (OECD, 2010; World Health Organization, 2010). A second requirement is that an intervention must be plausible; it should make sense in light of available scientific evidence. This criterion refers to the theoretical coherence of the functional mechanism of the intervention (Brousselle et al., 2011). Finally, an intervention must be well implemented. Resources and activities must be organized and mobilized in a way that can achieve the intervention's objectives. This criterion refers to the operational validity of the intervention (Brousselle et al., 2011).

In this study, we are interested in examining the relevance of the interventions to reduce physician shortages in rural regions, how well they can address the causes of physician shortages, and the plausibility of the interventions—whether they make theoretical sense. The following diagram presents the conceptual framework that forms the basis of this research. In Figure 1, the determinants of physician shortages in rural regions refer to the factors that cause the problem, labelled (1), which in turn has led to the response of implementing several interventions in OECD countries. The interventions work in a particular way, with their

functional mechanisms influencing the determinants of physician shortages, labelled (2). The theories underlying the functional mechanisms of the interventions are labelled (3).

Figure 1: Conceptual framework for the analysis of interventions to reduce physician shortages in rural regions of OECD countries



3.1 Study objectives

This research seeks to explain the persistence of physician shortages in rural regions of OECD countries, despite the implementation of interventions to improve the geographic distribution of physicians. Two research questions guide this study:

Question I: *Are the interventions implemented in OECD countries to address physician shortages in rural regions strategically relevant?*

- **a)** What are the causes of physician shortages in rural regions?
- **b)** Can the interventions address the causes of physician shortages, and how?

Question II: *Are the interventions implemented in OECD countries theoretically plausible?*

- **c)** Can the functional mechanisms of the interventions be explained in theoretical terms, and how?

To respond to the two research questions, three study objectives are proposed. The first objective, (a), is to explore and further understand the determinants of physician shortages in rural regions of OECD countries. The second objective, (b), is to analyze the ability of the interventions to address the causes of physician shortages. The third objective of this research, (c), is to analyze the theoretical basis of the interventions designed to reduce physician shortages in rural regions.

In the following chapter, the methodological framework followed throughout this research is explained. Chapter 5 details the results of this research and is presented in the form of three articles. The first article critically reviews the causes of physician shortages in rural regions of OECD countries. The second article is a strategic analysis of the interventions, assessing their relevance to the causes of the problem. The third and final article is a logic analysis of the interventions, which examines their theoretical foundation. Chapter 6 is a discussion of this research, and its policy implications, followed by a conclusion in chapter 7.

CHAPTER 4: Methodology

This research undertakes an evaluative approach to the interventions implemented in OECD countries to improve the geographic distribution of physicians. Evaluation is a method used in public health to systematically investigate the merit of intervention programs. In the context of increasingly complex healthcare systems, evaluation attempts to improve and account for public health actions, and to respond to the information needs of decision-makers and the rise in public vigilance towards health interventions (Brousselle, Contandriopoulos, & Lemire, 2009). Evaluations are conducted to provide feedback intended to enhance or modify program operations and improve the capacity to set policies and design and administer programs (Mark, Henry, & Julnes, 1999). Evaluation can change the understanding of a program, pinpointing its strengths and weaknesses and identifying new directions for action, and can serve as an instrument for persuasion and mobilizing support (Weiss, 1998). Evaluation can be described as "assisted sense-making": to observe, understand, and make judgments about policies and programs, and then undertake behaviors that capitalize on what has been learned (Mark et al., 1999).

Evaluation stems primarily from the social sciences, with an emphasis on needs, comparison, cost, and on making value judgments (Scriven, 1981). As a pluralistic field, evaluation encompasses several modes of inquiry and a variety of social research methods including description, classification, causal analysis, and values inquiry based on literature and records reviews, direct observation, interviews, surveys, censuses and needs forecasting (Brousselle et al., 2009; Mark et al., 1999). The exact methodological framework employed in program evaluation depends on the nature of the intervention and its complexity (Brousselle et

al., 2009; Donaldson, 2003; Patton, 2002). Intervention programs addressing public health problems, which often exhibit a distinct social dimension, lend themselves well to evaluations that can gauge their appropriateness and assess their effectiveness (Donaldson, 2003; Rossi & Lipsey, 2004). Evaluation focuses attention on the common purpose of public health programs—accountability and social betterment—through procedural frameworks that are useful, feasible, ethical and accurate (Donaldson, 2003; Mark et al., 1999; Scriven, 1981).

A theory-based evaluation can provide valuable information on social and public health interventions, and to the social science disciplines on which it is based, by placing scientific evidence at the foundation of decision making, as the basis of outcome-oriented action and as a tool for achieving greater social equity (H. T. Chen & Rossi, 1983). The failure of social and healthcare interventions has been attributed to the lack of attention to theory, which consequently results in poorly conceptualized programs that are based on a narrow or distorted understanding of causal mechanisms on one end, and "insensitive" evaluations that are unable to convey how an intervention is supposed to work on the other (H. T. Chen & Rossi, 1983; Donaldson, 2003).

4.1 Research methods

In this study, we are interested in examining the relevance of the interventions to reduce physician shortages in rural regions, how well they can address the causes of physician shortages, and the plausibility of the interventions—whether they make theoretical sense. These are two important criteria for an intervention to achieve its intended results (Brousselle & Champagne, 2011; Brousselle et al., 2011). To find out about the causes of physician shortages,

or about how interventions are theoretically supposed to work, a large number of disparate sources of evidence must be examined. Systematic reviews are seen as an insufficiently narrow approach to capturing and operationalizing a complex evidence base (Mays, Pope, & Popay, 2005).

To evaluate the interventions to improve the geographic distribution of physicians in OECD countries, three steps are followed. A critical review of the literature is conducted to fulfill the first objective of this study, which is to explore and gain a deeper understanding of the causes of physician shortages in rural regions. Descriptions are used in evaluations to elaborate on how the problem of interest is experienced by the population, perceptions about the interventions, and encountered difficulties (Rossi & Lipsey, 2004). An in-depth exploration of published studies and relevant documents from the "grey literature" serves to describe and classify the range of factors that determine where a physician will ultimately choose to establish medical practice. Subsequently classifying this information sheds light on other dimensions of complexity, such as the multi-level nature of the phenomena under study and its different manifestations across multiple sites (Rogers, 2008). When evaluating complex interventions, comparative analyses of similar policies implemented in different contexts helps reveal the multiple causal pathways that are in effect (Rogers, 2008).

The second objective of this research is attained by conducting a strategic analysis to evaluate the importance of the causes of physician shortages in rural regions and the extent of their contribution to the problem, and most importantly, the ability of interventions to address these causes. Strategic analysis builds upon the description and organization of the causes of a

public health problem, to deepen understanding of the contexts that influence physician choice of practice location. This is a type of evaluation that emphasizes the effect of contextual factors on the provision of health services, and utilizes strategic management and prioritization tools to rank interventions based on their ability to address the nature of the problem and the needs of the target population (Rossi & Lipsey, 2004). Strategic analysis fall under "valuative" modes of inquiry, where judgments are made about the merit of an intervention and its ability to address the circumstances that influence public health problems (Mark et al., 1999; Scriven, 1981).

The third and final objective is attained through the use of a logic analysis. Understanding the service needs of a target population and the contextual factors influencing them can reveal the assumptions, or hypotheses, inherent in the intervention's design about how the intervention works (Rossi, Lipsey, & Freeman, 2004; Tremblay, Brousselle, Richard, & Beaudet, 2013; Weiss, 1998). Logic analysis is an evaluative method that helps determine whether an intervention's underlying theoretical assumptions are congruent with existing research in the domain in question, with expert knowledge of those working in the field or in programs with similar concepts, or with the results of observation and testing of the intervention (Donaldson, 2003; Rossi et al., 2004). This can also be accomplished through a critical review of research on the social dynamics and psychological processes central to how the interventions work, which is the research method that is undertaken in this study (Rossi et al., 2004). Once the theoretical assumptions underlying the interventions are outlined, a theory-based evaluation verifies the logic and plausibility of these assumptions.

CHAPTER 5: Results

This chapter is composed of three articles corresponding to the three objectives of this research. The first article presents a critical review of the literature on the causes of physician shortages in rural regions. The second article strategically analyzes the causes of physician shortages, based on their importance and contribution to the problem, and subsequently assesses the interventions based on how they target the causes. The third and final article analyzes the theoretical underpinnings of the interventions and evaluates the interventions based on their theoretical plausibility.

5.1 Article 2: A critical review of the causes of physician shortages in rural regions of OECD countries

Alya Danish, François Champagne and Régis Blais

Abstract

Physician shortages in rural regions are prevalent across Organisation for Economic Cooperation and Development (OECD) member countries. A variety of interventions have been devised to address the maldistribution, with the ultimate objective of increasing the number of physicians practicing in rural regions. However, some of the studies evaluating these interventions suggest that the interventions are designed with no consideration of the causes of physician shortages. The purpose of this study, then, is to critically review the causes of physician shortages in rural regions of OECD countries. This research demonstrates that a physician's choice of practice location is determined by both individual and contextual factors. Findings suggest that interventions that focus exclusively on changing the behavior of physicians may be too limited in scope to change a physician's choice of practice location. Interventions that target the causes of physician shortages at multiple levels are more likely to achieve positive outcomes.

5.1.1 Introduction

Physician shortages in rural regions are prevalent across OECD member countries. A variety of interventions have been devised to address the maldistribution, with the ultimate objective of increasing the number of physicians practicing in rural regions. Regulatory policies, financial incentives, educational programs, and professional and community support measures

have been implemented in most developed countries, with the aim of encouraging physicians to set up their medical practice in underserviced rural areas, and at the same time, discouraging them from practicing in oversupplied urban areas. However, studies evaluating these interventions have reported weak or inconclusive results, and to date, no single intervention leading to a sustainable solution to the shortages of physicians in rural areas has been identified (Ono et al., 2014; World Health Organization, 2010). Some argue that interventions are designed with little consideration of the causes of physician shortages, which are attributed to a range of contextual factors, as well as to physician preference (Buykx et al., 2010; Dolea et al., 2010; Ono et al., 2014; Wilson et al., 2009; World Health Organization, 2010). Due to the complex and contextually dependent nature of the problem, the analysis of physician shortages must be viewed through a wide lens, something that has rarely been accomplished in research (OECD, 2010).

5.1.2 Problem description

The majority of policy responses to physician shortages in rural areas are designed on the basis of a traditional human resources management (HRM) approach, rooted in psychology and behavioural science theories that seek to outline the motivation behind a physician's choice of practice location, and to subsequently influence this choice in favour of rural areas (Bilodeau et al., 2006; Bourgeuil et al., 2006; Dolea et al., 2010; World Health Organization, 2010). This approach emphasizes psychological processes and micro-phenomena, the primacy of the individual, and the assessment of subjective properties, such as the thoughts, feelings, and actions of individual physicians (Hitt, Beamish, Jackson, & Mathieu, 2007; Mayrhofer, 2004; Molloy et al., 2010).

As a subfield of management, HRM is considered a "micro" discipline that focuses on individuals and small groups, and that is grounded in behavioural sciences and psychology (Aguinis, Boyd, Pierce, & Short, 2011; Molloy et al., 2010). The theoretical perspective adopted by human resources managers does, by definition, emphasize behavior and psychological processes (Mayrhofer, 2004; Molloy et al., 2010). Policy design that is rooted in HRM will most often deal with the individual, while the role of context is inevitably de-emphasized (Molloy et al., 2010). HRM policies dealing with staff retention and turnover are arguably "acontextual," placing less emphasis on structural influences, such as economic and institutional conditions that affect the behaviour of individuals, in favour of a technical and goal-oriented approach, which may come at the detriment of a critical view of the workplace (Johns, 2006; Veliquette, 2012). In terms of designing programs to influence a physician's choice of practice location, a traditional HRM approach may have resulted in a "non-systematic" approach to policy-making, which extracts the individual physician from their context (Grobler et al., 2009; Johns, 2006).

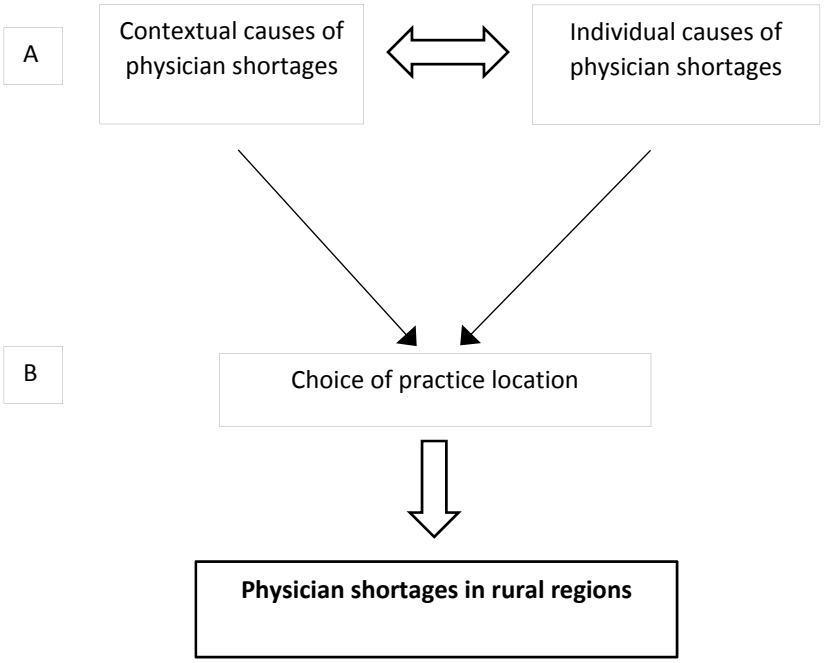
Some HRM scholars advocate for a comprehensive theoretical framework, which links the individual with the organization and larger society, and offers the opportunity for multilevel and multi-actor analysis (Mayrhofer, 2004; Veliquette, 2012). Health human resources management policies must better account for the range of individual characteristics and contextual factors, and their mutual interaction, contributing to organizational phenomena (Dubois & Singh, 2009; Dussault & Dubois, 2003). There is agreement among some researchers interested in the problem of physician shortages in rural regions of OECD countries that to design effective solutions, the multilevel causes of physician shortages, and their interactions,

must be identified. The optimal mix of factors that must be targeted by the intervention can subsequently be taken into account in the intervention's design (Ono et al., 2014; Secretariat, 2012; World Health Organization, 2010).

5.1.3 Conceptual framework

The following diagram is a conceptual framework of the causes of physician shortages in rural regions. In Figure 2, the interaction of contextual and individual factors, represented by the letter (A), influences a physician's choice of practice location, represented by the letter (B). The resultant choice of rejecting the rural in favor of urban practice leads to the shortage of physicians in rural regions.

Figure 2: Conceptual model of the causes of physician shortages in rural regions of OECD countries



Context is an abstract construct, most simply defined as the set of circumstances in which phenomena such as events, processes or entities are situated (Griffin, 2007). Context usually refers to factors that are situated at higher levels of analysis than the phenomena under investigation (Bamberger, 2008; Griffin, 2007). In organizational research, contextual factors preclude individual and small group behaviour and interactions (Kozlowski, Chao, Grand, Braun, & Kuljanin, 2013).

Based on a sociological understanding of the individual/contextual duality, individual factors are those related to personal attributes, actions, relationships, and small group interactions with the individual at their center, such as family dynamics, as well as factors related to social position, status, roles, symbols and the construction of meaning (Marshall, 1994; Ritzer, 1996). Contextual factors are those related to administrative structures, social institutions, population or demographic phenomena, and the global and historical processes of social life (Marshall, 1994; Ritzer, 1996). The arrows between the contextual and individual causes of physician shortages indicate a continuous relationship of mutual dependence and influence.

5.1.4 Objectives

The objective of this article is to achieve an in-depth understanding of the causes of physician shortages in rural regions of OECD countries by exploring the individual and contextual-level determinants of physician practice location. This research presents valuable information for the analysis of interventions to improve the geographic distribution of physicians and highlights future direction for policy design.

5.1.5 Methods

We adopt the methodology suggested by (Mays et al., 2005) for reviewing qualitative evidence for management and policy in the health field to review publications related to the causes of physician shortages in rural regions of OECD countries. The authors describe their strategy as a "realist" approach, also used in theory-based evaluations of complex, context-dependent interventions (Mark et al., 1999; Mays et al., 2005; Pawson & Tilley, 1997). The aim is to uncover an external, objective "truth" from multiple descriptions or subjective explanations of a given phenomenon (Mark et al., 1999; Mays et al., 2005). In theory-based evaluations, realism helps to identify causal connections between meaningful groupings of perceived objects and experiences in order to reveal a common underlying theme (Mark et al., 1999).

When searching and selecting publications for review, the aim is for breadth: to cover different types of publications from multiple disciplines in an attempt to account for both "internal" (individual) and "external" (contextual) conditions influencing physician practice location (Mays et al., 2005). This strategy makes use of large volumes of descriptive data that may otherwise be excluded from systematic reviews (Mays & Pope, 1995). Purposeful sampling identifies those publications that fill the theoretical categories of individual/contextual causes of physician shortages (Mays & Pope, 1995). Selected studies are systematically and iteratively compared against these constructs for theoretical refinement, as well as to verify causal relationships (Mays & Pope, 1995).

Search strategy

Publications were initially selected from the OECD and WHO publication databases, from a number of large-scale systematic reviews on the causes of physician shortages in rural regions. From there, a snowballing of citations led to a broad range of studies from diverse disciplines and countries. Relevant grey literature was selected since interventions are often documented in country reports and government publications.

A second line of inquiry was then established through a review of MEDLINE. Keywords used for this search include "causes/determinants," "physicians/healthcare workers/healthcare personnel," "geographic," "distribution/shortage," and "rural/remote/isolated/underserved/underserviced." Only studies published between January 1995 and December 2014 were searched. Publication language was limited to English and French.

This step was followed by another snowballing of citations using Google Scholar, leading to eligible publications from various disciplinary traditions. Studies were added until a theoretical saturation was reached. The search was stopped when incremental learning became minimal due to the same causes/determinants of physician shortages being repeatedly identified in the literature (Eisenhardt, 1989).

Inclusion and exclusion criteria

Only studies from OECD member countries pertaining to the causes or determinants of physician practice location or to the shortage of physicians in rural regions are considered.

Studies published in peer-reviewed journals, international agency reports, and studies commissioned by country governments are included. Only interventions applicable to physicians and student physicians are included in the study. Studies addressing nurses or allied health professionals, military personnel or developing countries are excluded.

5.1.6 Results

A total of 97 publications are included in the review, each addressing one or several determinants of physician medical practice in rural areas, or causes of physician shortages in these areas.

Out of the 97 articles, 33 come from public health research, including journals covering health policy and healthcare management and administration. Journals covering rural health topics are the source of 24 articles included in this review, while 20 articles came from medical journals. A total of 11 publications were based in social science journals, covering areas such as economics, geography, and sociology, while nine articles were sourced from journals in the fields of organizational sciences.

Canadian-based research accounts for 28 of the reviewed publications, while 26 articles were published in the US and 18 in Australia. Another seven articles came from France, six from the UK, five from Switzerland, and three from South Africa. The Netherlands, New Zealand, Japan, and Germany accounted for one article each.

Selected studies include 14 systematic reviews and six cohort studies, while the remaining publications are made up of descriptive studies, government documents and expert opinion.

A critical review of these studies identified 26 causes of physician shortages in rural regions of OECD countries. Based on the conceptual framework for this research, 19 of these causes are categorized as "contextual," while the remaining seven causes are considered to be specific to the "individual" physician. These are thematically referred to as *physician background and interest*. The 17 contextual causes were grouped thematically to include *professional trends, community characteristics,* and *the organization of rural medical practice*. These results are presented in Table 3.

Table 3: Causes of physician shortages in rural regions

	Contextual Causes		**Individual Causes**
	Professional trends		**Physician background and interests**
1	Aging population	20	Lack of interest or experience in primary care
2	Global migration	21	Distance from extended family and friends
3	Increase of women in medicine	22	Non-rural background and experience
4	Importance of a balanced lifestyle	23	Spousal non-rural background or disinterest in rural life
	Community characteristics	24	Advantaged/non-minority background
5	Harsh climate	25	Lack of community service orientation
6	Geographic isolation	26	Debt
7	High concentration of minority & low SES groups		
8	Poor infrastructure of rural regions		

9	Lack of community support for physicians
10	Lack of spousal employment
11	Lack of educational options for children
12	Lack of leisure opportunities
	Organization of medical practice
13	Inadequate health resources and physician supply planning
14	Physician monopolies
15	Poor rural medical practice infrastructure
16	Inadequate incentive structures
17	Lack of professional support for rural physicians
18	Difficulty of rural medicine
19	Lower ranking of rural medical specialties

Professional trends

There are two dimensions of *aging* that can affect the supply of physicians: the aging of the general population, which results in the increased demand for health care services, and the aging of the physician population, which results in a reduced supply of health care services (S. A. Cohen, 2009; Colwill, Cultice, & Kruse, 2008; Dumont et al., 2008; OECD, 2008; Pond & McPake, 2006; Simoens & Hurst, 2006). Most OECD member countries report a rapidly aging rural population, with an increase of retirees moving to rural regions (OECD, 2010).

Physician shortages in rural regions are attributed to professional trends, like *global*

migration, or "brain drain," which is common to all countries and all professions and is observed between and within countries (Buykx et al., 2010; Dumont et al., 2008; Grobler et al., 2009; Kabene et al., 2006). The patterned migration of the workforce is attributed to socioeconomic reasons, as professionals are drawn to the potential for higher incomes and to a greater range of amenities and opportunities for development and education, found predominantly in metropolitan areas (Pond & McPake, 2006; Ricketts & Randolph, 2007; J. Rourke, 2008; J. T. Rourke, Incitti, Rourke, & Kennard, 2005; Simoens & Hurst, 2006; Zurn et al., 2004).

The *increasing number of women* entering the medical profession is a professional trend observed across OECD countries (Dumont et al., 2008; Grobler et al., 2009; Pond & McPake, 2006; Pong & Russell, 2003; H. K. Rabinowitz et al., 2008). Women have been found to prefer urban medical practice, and are less likely to practice in rural areas due to the lack of childcare options, the lack of social and professional support, and physical isolation leading to safety concerns (Crossley, Hurley, & Jeon, 2009; Curran et al., 2004; Dubois & Singh, 2009; Grobler et al., 2009; OECD, 2008; H. K. Rabinowitz et al., 2008).

Physician work hours are generally in decline in comparison to recent years, due to the increasing *importance of lifestyle* and *work/leisure balance* (Bilodeau et al., 2006; Crossley et al., 2009; Curran et al., 2004; Dumont et al., 2008; Pond & McPake, 2006; H. K. Rabinowitz et al., 2008). Long work hours are rejected for the possibility of personal development, a healthy work environment, a friendly community, and the availability of amenities for all family members (Buykx et al., 2010; Dubois & Singh, 2009; Laurence et al., 2010; Simoens & Hurst, 2006). Younger generations of physicians aim for an overall sense of fulfillment, where career,

family, social life, leisure, and a rapport with the natural environment are considered requisites to a higher quality of life (Bilodeau et al., 2006; Buykx et al., 2010).

Community characteristics

Geographical factors such as *climate* and *topography* have an impact on the supply and demand of human health resources (Kabene et al., 2006; Martinez et al., 2004; OECD, 2010). Some rural regions experience particularly difficult weather conditions, such as extreme heat in Australia, or extreme cold and heavy snow in Canada, which can be a permanent hindrance to physician retention in northern regions (Dumont et al., 2008; Ono et al., 2014). Dense forestation or mountainous locations are similarly challenging (Dussault & Franceschini, 2006). The vastness and *geographic isolation* of some rural areas in Canada, the US, and Australia, means long travel distances to amenities or metropolitan centers, and social isolation from family, friends and the medical community (Bilodeau et al., 2006; Fournier et al., 2004; N. Hanlon, Halseth, & Snadden, 2010; Kearns et al., 2006; OECD, 2010; Pathman et al., 2004; J. Rourke, 2008; Viscomi et al., 2013; World Health Organization, 2010).

Rural regions are composed of a larger percentage of "disadvantaged" populations, such as *aboriginal and indigenous groups*, as well as those occupying a *lower socioeconomic status* and exhibiting a poorer health status (CIHI, 2006; Curran et al., 2004; J. Humphreys et al., 2007; Simoens & Hurst, 2006; Wakerman et al., 2008). Lower educational attainment, unemployment, lower wages and general economic hardship are identifying characteristics of many rural regions, which are thought to require particular medical and social skills from a physician (Felix et al., 2003; J. Humphreys et al., 2007; Kearns et al., 2006; Laurent, 2002; Pathman et al., 2004;

Ricketts & Randolph, 2007; Vanasse, Courteau, Cohen, Orzanco, & Drouin, 2010; Wilson et al., 2009). Studies show that rural populations have higher mortality rates, and are at greater risk of dying from diabetes, heart disease, cancer, alcoholism, and suicide, which is an added challenge that some physicians are unwilling to face (CIHI, 2006; Felix et al., 2003; Laurent, 2002; Vanasse et al., 2010).

The *poor infrastructure of rural areas* is manifest in poor road maintenance, the lack of public transport, poor living conditions, and a lack of availability of quality housing (Bourgeuil et al., 2006; Felix et al., 2003; Grobler et al., 2009; Martinez et al., 2004). The lack of technological infrastructure limits the ability to communicate with professional or personal networks (Buykx et al., 2010; Curran et al., 2004; OECD, 2010; Wakerman et al., 2008). Rural regions may suffer from industrial pollution leading to poor sanitation, lower air and soil quality, and a lack of clean drinking water (Grobler et al., 2009; Laurent, 2002).

Rural physicians may be surprised by a *lack of community support,* and face difficulty integrating within the community (Buykx et al., 2010; Hancock, Steinbach, Nesbitt, Adler, & Auerswald, 2009; Laurence et al., 2010). Some communities harbour bitter sentiments towards a new physician, their position of authority, and their salary, especially if this physician originates from an urban area (J. Humphreys et al., 2007). In other cases, doctors complain about the lack of anonymity and the fact that they are regarded as community property (Kearns et al., 2006).

The lack of *employment opportunities for spouse* is another challenge to physicians contemplating a career in a rural region, as job prospects are scarce and career advancement is

limited in most jobs (Felix et al., 2003; Grobler et al., 2009; Laurent, 2002; OECD, 2010). Physician families must also consider the *lack of educational options for children* before making the decision to set up a rural medical practice. The quality of education for children in rural regions is reportedly lower than in urban regions; there may not be daycare facilities or nursery schools for younger children, and schooling options are usually limited, particularly at the secondary level (Grobler et al., 2009; J. Humphreys et al., 2007; Laurence et al., 2010; J. Rourke, 2008).

Finally, many rural regions *lack opportunities for leisure* such as gyms, tennis or basketball courts, or infrastructure for outdoor sports such as skiing, hiking or water sports (Bilodeau et al., 2006; Viscomi et al., 2013; Zurn et al., 2004). The presence of commercial and cultural facilities is an important component to attracting and maintaining physicians to rural regions; these facilities work to alleviate boredom and feelings of isolation and provide an outlet for children (J. S. Humphreys, Wakerman, & Wells, 2006; Kearns et al., 2006; Laurence et al., 2010).

Organization of rural medical practice

Physician shortages in rural regions have been attributed to a number of factors related to the way medical practice is organized. The *inadequate health resources management and physician supply planning* at the central government level is a contributing factor to physician shortages in rural regions. Sources suggest that physician supply planning is done with no consideration for the geographic distribution of physicians, changing economic and health

service delivery contexts, or the complexity of variables such as retirement patterns, other health workers' retention rates, expenditure projections, task sharing by other clinicians and non-clinicians, and performance measurements (Bloor & Maynard, 2003; Fournier, 2001; J. S. Humphreys et al., 2006; Kirch et al., 2012; Ono et al., 2013).

Physician monopolies contribute to imbalances in the supply of health services to rural regions. In the US, the American Medical Association maintains market power by controlling the distribution of licences to practice medicine and lobbying against the supply of healthcare services by non-physician health professionals; similar situations have been reported in France, Austria, Belgium, Germany and Switzerland (Simoens & Hurst, 2006; Zurn et al., 2004). Price-fixing of the cost of healthcare services by physician associations inhibits competition and creates imperfect market conditions, making innovative healthcare delivery initiatives such as skill-mix schemes, which can alleviate shortages in physician supply, impossible (Bloor & Maynard, 2003; OECD, 2010; Zurn et al., 2004). As a result, anti-trust legislation has been instated in Australia, and the application of vigorous competition policies for physicians have been proposed in the UK, France, Germany and Canada (Bloor & Maynard, 2003; OECD, 2010).

A *poor rural medical practice infrastructure* deters physicians from rural regions because clinic practice management or business models are often non-existent, so it is up to the physician's own entrepreneurial prowess to set up a clinic (J. S. Humphreys et al., 2006; Laurence et al., 2010; Pathman et al., 2004). Rural hospitals can be far away, understaffed, and ill-equipped (Fournier, 2001; J. S. Humphreys et al., 2006; Laurence et al., 2010). The lack of specialty services places an added stress on the rural physician due to the range of clinical tasks

that may need to be performed (Curran et al., 2004; J. S. Humphreys et al., 2006; Laurence et al., 2010; OECD, 2010).

While studies show that financial considerations are not the most important factor in a physician's decision to practice in a rural region, an *inadequate incentive structure* is consistently cited as a barrier to long-term retention in rural regions (Bilodeau et al., 2006; Buykx et al., 2010; Pathman et al., 2004; J. Rourke, 2008). Compensation schemes do not adequately reflect the hardships associated with rural medical practice, and the symbolic value of remuneration for the particular nature of rural medicine tends to be underestimated (Bloor & Maynard, 2003; Fournier et al., 2004; Grobler et al., 2009; J. Rourke, 2008). Appropriate financial incentives are thought to be an important countermeasure to rural-urban disparities (Viscomi et al., 2013; World Health Organization, 2010).

The *lack of professional support for rural physicians* is a challenge for the physician who is the sole health provider in a community, with few options for mentoring, assistance, or the opportunity to balance workload and professional responsibilities (J. Humphreys et al., 2007; Laurence et al., 2010; Quinn & Hosokawa, 2010; World Health Organization, 2010). Accessing opportunities for professional development, continuing medical education (CME), or seminars or conferences may require extensive travel and significant costs (Buykx et al., 2010; Laurence et al., 2010; Laurent, 2002). This leads to a sense of being "cut off," and to the perception that rural medicine limits future career options and development (Bilodeau et al., 2006; Dussault & Franceschini, 2006; J. A. Henry, Edwards, & Crotty, 2009).

The *difficulty of the rural medical specialty* is evidenced by reports of high stress levels, depression, burnout, and low retention rates resulting from the enormous workload, and from constantly being on-call (Buykx et al., 2010; Curran et al., 2004; Fournier et al., 2004; Kearns et al., 2006; Laurent, 2002). Rural physicians commonly perform non-clinical functions such as community-based epidemiological research, health education, and activities to improve the local healthcare delivery system (Curran et al., 2004; J. S. Humphreys et al., 2006; Kearns et al., 2006).

A flawed professional culture that promotes specialization results in a *lower ranking of rural medicine*, which is considered a primary care specialty, further restricting the pool of candidates for this career path (Ricketts & Randolph, 2007). Learning experiences are reported as being skewed in favour of urban, tertiary practice (Dussault & Franceschini, 2006). Students are discouraged from pursuing careers in primary care by instructors and peers, and few role models exist for rural medicine (Curran et al., 2004; Leduc et al., 2011; Lu et al., 2008; Murray, Larkins, Russell, Ewen, & Prideaux, 2012; J. Rourke, 2008).

Physician background and interests

The *lack of interest or experience in primary care*, or an interest in specialty medicine or technological advances in medicine, are negatively associated with choosing to practice in a rural area (Barnighausen & Bloom, 2009; Crump et al., 2004; Laurent, 2002; Ricketts & Randolph, 2007). Inversely, working in underserved regions is associated with an interest in family medicine, obstetrics and gynecology, and psychiatry (Porterfield et al., 2003). Students who

become interested in working in rural communities come from family medicine backgrounds, rather than from specialties (Avery et al., 2012; Manusov et al., 2010).

The *distance from extended family and friends* is an important consideration for a physician's choice of practice location, and factors relating to social life are consistently given importance by physicians (Bilodeau et al., 2006; Crump et al., 2004; Fournier et al., 2004; J. Humphreys et al., 2007; J. Rourke, 2008). Physicians from *non-rural backgrounds* are less likely to be interested in rural medicine at the outset (J. Humphreys et al., 2007; World Health Organization, 2010). Exposure to rural regions or rural medicine during undergraduate or postgraduate medical education, especially longer periods of immersion in rural culture, is associated with future rural practice (Laven & Wilkinson, 2003; Quinn & Hosokawa, 2010; J. Rourke, 2008; J. T. Rourke et al., 2005).

A physician's *spouse's non-rural background* has almost as much bearing on future rural medical practice as the origin of the actual physician (Avery et al., 2012; Chan et al., 2005; Felix et al., 2003; J. Humphreys et al., 2007; H. K. Rabinowitz et al., 2008; Ricketts & Randolph, 2007; J. Rourke, 2008). A partner who is not interested, committed or able to work in a rural area has a strong negative impact on a physician's choice of practice location (Bilodeau et al., 2006; Fournier et al., 2004; J. A. Henry et al., 2009).

A physician with an *advantaged/non-minority background* is less likely to choose rural medical practice. Membership in a disadvantaged group, measured in terms of lower parental income, father's educational status, or having grown up in medically underserved areas, is

associated with an interest in rural medicine and with caring for people in similar situations (Orzanco et al., 2011; Porterfield et al., 2003; World Health Organization, 2010). Physicians who are members of minority groups are also more likely to practice in rural regions, or serve the underprivileged (Porterfield et al., 2003; H.K. Rabinowitz et al., 2000; Xu et al., 1997).

A related determinant of reluctance to work in a rural area is the *lack of a humanitarian/community service orientation*. Medical students who place an emphasis on humanistic values and attitudes, and who are involved in community service and volunteerism, are more likely to express interest in rural medicine (Avery et al., 2012; Chan et al., 2005; Hancock et al., 2009; Muller & Kase, 2010; Quinn & Hosokawa, 2010; World Health Organization, 2010).

Heavy student *debt* affects the choice of practice location (Bilodeau et al., 2006; Lu et al., 2008). The greater the debt incurred by a physician during schooling and training, the less likely that a primary care specialty will be chosen, and the less likely that rural medicine will be considered at all, due to the lower salaries of primary care physicians (J. Rourke, 2008). The ability to pay off debts as a rural physician is thus an important determinant of whether rural medicine can appeal to a medical student (J. Humphreys et al., 2007; J. Rourke, 2008).

5.1.7 Discussion

An examination of the causes of physician shortages in rural regions of OECD countries reveals that there are 19 contextual causes of physician shortages, related to professional trends, to the characteristics of the rural community, and to the way in which rural medical practice is

organized and managed. There are seven individual causes of physician shortages, related to the individual physician's personal background, experience and interests. The intention of this research was to achieve an in-depth understanding of the causes of physician shortages, in order to provide a complete description of all the causes that need to be addressed by an intervention policy.

This is the first study to attempt to explore and classify the causes of physician shortages in rural regions of OECD countries based on a sociological understanding of the individual/contextual duality. The thematic classification, based on conceptual framework rooted in social science theory and scientific evidence, helps in two regards. It allows for the grouping of the causes into categories based on shared characteristics, and illuminates aspects of the problem that may not have been obvious from a simple reading of the available literature. At the most macro level, population trends shed light on global patterns, such as aging populations and international migration, that are consistent across all OECD countries and are common to all professions. Macro-level causes of physician shortages are a reflection of patterned inequalities that are symptomatic of the socioeconomic differences and the persistent disadvantage experienced by rural populations. Global and population patterns provide the researcher with a "grand natural experiment": an opportunity to examine and reflect upon the underlying cause of physician shortages (Marmot, 2006).

The contextual causes of physician shortages are further classified at the meso level, which includes organizational causes related to the management of rural medical practice, and community causes related to infrastructure and amenities, or to the rapport between the physician

and community members. This suggests that the source of physician shortages in rural regions can be traced back to the lack of priority given to rural medicine; this starts at the level of government and health ministries and extends to medical schools, where the way rural medicine is managed and taught contributes to the shortages of physicians. It also suggests that there may be a lack of attention to the concerns of rural communities, where the disadvantages experienced by minorities and those belonging to lower socioeconomic status groups is compounded by the lack of services and poor infrastructure.

Finally, at the individual, or micro, level, causes related to the physician's personal background, interest, and experience may be further grouped into thematic levels, similar to contextual causes. Debt, spousal background, and distance from family can be described as "personal context"; they are "higher order" individual causes, which lay closer to the meso level, where other contextual causes are categorized. Lack of interest in primary care and community service are "personal preferences," and are situated closer to the micro level, but the non-rural and non-minority background are closest to the individual's inner psychological processes.

The importance of the findings of this study are twofold. First, these findings demonstrate that exclusive focus on altering physician behavior may not be a sufficient approach to improving rural physician shortages, given the scope and complexity of the determinants of the choice of practice location. Interventions may be more effective if they are designed with the understanding that individual action is influenced by the greater context (Ono et al., 2014; World Health Organization, 2010). Studies suggest that, given the complexity of health care systems, policy development and implementation should be "multidimensional": designed to anticipate

the influence of several levels of contextual factors (Hitt et al., 2007; Johns, 2006; OECD, 2010). Ignoring context can shift focus away from the potential root causes of physician shortages in rural regions. Root causes, also referred to as "causes of causes," "essential determinants," or "underlying causes," are the factors that generate exposure to other causes, thereby exacerbating the problematic situation (Marmot, 2006; McLaren, McIntyre, & Kirkpatrick, 2010; Rose, Khaw, & Marmot, 2008). This places an unfair burden on individual physicians; they may, for example, have to make up for the inefficiencies in the organization of health care, or in the provision of health services to rural regions, which are contextual factors that constrain the choice of practice location. This would also result in temporary "band-aid" solutions, because the problem is just being managed rather than prevented, or treated, at its source (McLaren et al., 2010).

Second, the findings of this research are important because they confirm one part of the argument against the interventions that have been implemented in OECD countries to improve the geographic distribution of physicians: that physician shortages are caused by a range of individual and contextual factors. The second part of the argument is that interventions are aimed at a micro level, to influence the physician's behavior without consideration of the causes of this behaviour (Bourgeuil et al., 2006; Dolea et al., 2010; World Health Organization, 2010). Referring back to Figure 2., when studies suggest that interventions based on a traditional HRM approach target behavior change without considering context, this means they are only intervening at point B, when they should also be intervening at point A. They are trying to change physician behavior, to have more physicians choose rural over urban practice location, without considering the wide range of individual and contextual factors that influence this behaviour (Buykx et al., 2010; Ono et al., 2014; Wilson et al., 2009). This has not been

confirmed by this study. Further research is required to examine the theoretical foundation of the interventions designed to address the geographic maldistribution of physicians. Logic modelling, also referred to as theories of change, is a program evaluation approach whose purpose is to test the assumptions about how an intervention is supposed to work (Brousselle et al., 2011; Funnell & Rogers, 2011; John Mayne, 2012).

This research provides a concise and simple classification of the causes of physician shortages in rural regions that is anchored in social science theories, foundational for the fields of social and public health policy intervention and evaluation (H. T. Chen & Rossi, 1983; Scriven, 1981). The interventions implemented in OECD countries to increase the number of physicians practicing in rural regions may be re-examined in light of the information presented in this research. One approach would be to evaluate the ability of interventions to address the causes of physician shortages. Furthermore, based on the context of specific geographical regions, the causes of physician shortages may be prioritized, and strategic choices can be made about which causes to target (Brousselle et al., 2011). For example, it is observed that environmental characteristics vary significantly across OECD countries. Harsh climates, vast territories and geographic isolation are salient problems in Canada and Australia, less so in Europe. A causal analysis can further examine the direction and mechanism of influence of each of the causes of physician shortages, develop a plausible sequence of cause and effect, and provide a guideline for the areas of intervention most likely to achieve the intervention objectives (Miles, Huberman, & Saldana, 2014). This research therefore informs evaluation and policy design.

We acknowledge that there are other disciplinary perspectives to the problem of physician shortages in rural regions that use other classifications or conceptual frameworks. (Orzanco et al., 2011) use a nature vs. nurture dichotomy to identify factors that predict the practice location of the graduates of Université de Sherbrooke and the University of British Columbia schools of medicine, and find that "adding a nurture variable" to intervention, defined as educational strategies, improves the chances that physicians will practice in non-metropolitan areas. (Weinhold & Gurtner, 2014) examine the shortages of *health care services* in rural areas, detail the reasons behind the shortages, and propose a thematic classification system based on the type of service shortage that includes *provider shortage*, *maldistribution*, *quality problems*, *access limitations*, and *inefficient utilization*. While these studies use different methods or examine other angles of physician shortages, they are similar to this research in the wider theoretical perspective used to analyze the research problem. Similar conclusions are reached regarding the multidimensional, or multi-level, nature of the physician's choice of practice location.

5.1.8 Conclusion

Physician shortages in rural regions of OECD countries are the result of the physician's own personal background, interest, and experience, but also the result of contextual causes. These relate to the organization of rural medical practice, the characteristics of rural communities, professional trends, and environmental characteristics. Interventions to address physician shortages in rural regions that account for the influence of these causes on a physician's choice of practice location may demonstrate more favorable outcomes.

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5.2 Article 3: A strategic analysis of interventions to improve the geographic distribution of physicians in OECD countries

Alya Danish, Régis Blais, François Champagne

Abstract

A persistent problem of physician shortages in rural and remote regions across Organisation for Economic Cooperation and Development (OECD) member countries has led to the development of regulatory, financial, educational, and tailored interventions designed to increase the number of physicians practicing medicine in rural and remote regions. However, studies of the effectiveness of interventions present weak or inconclusive results. The interventions are said to be designed without accounting for the individual and contextual causes of physician shortages. The purpose of this study is to evaluate the relevance of the interventions. Based on the results of a critical review of the causes of physician shortages, a strategic analysis allows for the prioritization of the causes of physician shortages, and the subsequent ranking of the interventions based on their ability to target these causes. This research demonstrates that establishing medical schools in rural regions is the most effective intervention strategy, which targets the greatest number of priority causes of physician shortages. Financial interventions targeting practicing physicians and non-traditional health services delivery strategies are the next most effective interventions. A strategic analysis allows for the conclusion that all of the interventions are designed in a way to respond to the causes of physician shortages. The persistence of physician shortages in rural regions of OECD countries cannot be attributed to the irrelevance of the interventions to rectify the geographic maldistribution.

5.2.1 Introduction

A persistent problem of physician shortages in rural and remote regions across OECD member countries has led to the development of various interventions to improve the geographic distribution of physicians (OECD, 2008, 2010). Regulatory, financial, educational and tailored interventions are designed to encourage physicians to set up their medical practice in underserviced, rural, or remote areas, and at the same time, discourage them from practicing in oversupplied, urban areas (Ono et al., 2014). However, no single intervention leading to a sustainable solution to the shortages of physicians in rural areas has been identified (World Health Organization, 2010).

5.2.2 Problem description

Studies of physician shortages in rural regions of OECD countries suggest that it is a complex phenomenon determined by multiple causes (J. Humphreys et al., 2007; Scott et al., 2013; Viscomi et al., 2013). Causes related to the individual physician, such as personal background, characteristics, and interests, as well as factors such as social, community and family support, are determinants of physician practice location (Bilodeau et al., 2006; Simoens & Hurst, 2006). Rural community characteristics such as local government and infrastructure, the immediate work environment, and how local health care delivery is organized, have also been found to be important influences on physician practice location (Buykx et al., 2010; Dussault &

Franceschini, 2006). Other contextual variables, such as demographic changes, technological advances, health care reform, the institutional environment, and the nature of medical practice itself, have been found to influence the physician workforce (L. Chen et al., 2004; Dussault & Dubois, 2003). Some causes of physician shortages are considered "systemic," such as the lack of attention to rural concerns at the domestic policy level (N. Hanlon et al., 2010; J. Humphreys et al., 2007). Table 3 displays 26 causes of physician shortages in rural regions in OECD countries, thematically classified, based on whether each cause is related to "individual" physician characteristics, or to "contextual" variables (Danish, Blais, Champagne).

Table 3: Causes of physician shortages in rural regions

	Contextual Causes		Individual Causes
	Professional trends		Physician background and interests
1	Aging population	20	Lack of interest or experience in primary care
2	Global migration	21	Distance from extended family and friends
3	Increase of women in medicine	22	Non-rural background and experience
4	Importance of a balanced lifestyle	23	Spousal non-rural background or disinterest in rural life
	Community characteristics	24	Advantaged/non-minority background
5	Harsh climate	25	Lack of community service orientation
6	Geographic isolation	26	Debt
7	High concentration of minority & low SES groups		
8	Poor infrastructure of rural regions		
9	Lack of community support for physicians		
10	Lack of spousal employment		
11	Lack of educational options for children		

12	Lack of leisure opportunities
	Organization of medical practice
13	Inadequate health resources and physician supply planning
14	Physician monopolies
15	Poor rural medical practice infrastructure
16	Inadequate incentive structures
17	Lack of professional support for rural physicians
18	Difficulty of rural medicine
19	Lower ranking of rural medical specialties

Despite this knowledge, a recent OECD report describes policy responses to physician shortages in rural areas as "largely conceived and implemented in the absence of evidence" (Ono et al., 2014). One of the main critiques levelled at interventions is that they do not match the reasons why physicians choose their practice location, in other words, the underlying causes of physician shortages are not taken into account in the design of policy responses (Dolea et al., 2010; Lehmann et al., 2008; Ono et al., 2014).

5.2.3 Conceptual framework

Strategic analysis is a type of program evaluation used in the health and social services. It is an evaluative approach that rests on two important principles. The first is that interventions must target the causes of a problem in order to achieve their objective of solving the problem

(relevance). The second is that the causes of a problem are not equal; depending on the specific situation, some may contribute more to the problem than others (priority). Strategic analysis uses priority-setting methods to rank and order public health problems and their solutions, based on which need to be addressed first and how they will be addressed, while also taking into account the needs of the target population (Brousselle et al., 2011; Pineault, 1995).

Strategic analysis shares similarities with the evaluation framework used by the OECD, the United Nations Evaluation Group (UNEG), and the World Health Organization (WHO) to evaluate interventions (Group, 2013; Organization, 2013). It assesses the relevance of interventions, or in other words, the coherence between the activities of the intervention and the target problem. Relevance questions whether interventions "make sense regarding the conditions, needs or problems" to which they intend to respond, and examines whether interventions are consistent with an organization's priorities and mandate (Organization, 2013).

Strategic analysis uses similar tools to those used in strategic planning, which does not rely on experimental methods, but on a number of techniques used in prioritization and program planning exercises, such as context mapping and causal modelling. Existing data, such as published reports, demographic or socioeconomic indicators, health-related databases, or reports of the utilization patterns of various services, are used to assess the causes and/or solutions to a problem and prioritize the actions necessary to move forward (Pineault, 1995). A second approach to strategic analysis in the health and social services is to collect first-hand data through interviews from key informants, stakeholders, or policymakers involved in the issue

under investigation (Brousselle et al., 2011). An important advantage of strategic analysis is that it can be performed at any point during an intervention to evaluate the relevance of the choice of problems that are targeted by the intervention (Brousselle et al., 2011).

5.2.4 Objectives

This chapter examines the criticism that interventions to improve the geographic distribution of physicians in OECD countries are designed without recourse to empirical evidence of the shortage of physicians in rural regions and its causes. A strategic analysis is used to achieve two objectives. First, the causes of physician shortages in rural regions are prioritized. Second, the interventions to improve the geographic distribution of physicians that have been implemented across OECD countries will be analyzed based on their ability to target the most important causes of physician shortages in rural regions.

5.2.5 Methods

First, to prioritize the causes of physician shortages in rural regions, three criteria are utilized: importance, severity, and solvability.

Importance is a criterion that refers to the size of a problem, and may include indicators such as the number of persons affected by a health condition (Pineault, 1995). The *importance* of a cause to physician shortages is based on the number of published articles that identify said

cause as a determinant of physician shortages in rural regions. The articles are categorized according to the strength of the evidence they provide (Canada, 2015). Descriptive studies or expert opinion are given a weight of 1, cohort or case control studies are given a weight of 2, and systematic reviews are given a 3.

Severity refers to the impact of a problem, and may include indicators such as morbidity rates or the costs attributed to the problem (Pineault, 1995). In this study, the severity score is based on the number of causal relationships that each cause exhibits with every one of the other causes of physician shortages. *Severity* does not indicate the direction, nor degree, of association, only whether a causal relationship has been identified in the reviewed literature. Causes that are associated with 0–4 other causes are considered low severity, and receive zero points. Causes that are associated with 5–9 other causes are considered medium severity, and receive five points. Causes that are associated with 10 or more other causes are high severity, and receive an additional 10 points.

The solvability of a cause is scored as high or low, based on "how well this problem can be solved, if at all" (J. J. J. Hanlon & Pickett, 1990; Pineault, 1995). High solvability receives a factor of 2, while low solvability receives a factor of 1. These scores indicate the potential for conceiving and implementing solutions to that particular cause of physician shortages. Some causes of physician shortages are considered in the literature to be outside the realm of public health intervention (OECD, 2008). Others are considered unmodifiable according to reviewed studies (J. Humphreys et al., 2007; Pathman et al., 2004). These causes receive a low solvability

score. Alternatively, some causes are modifiable issues—such as those relating to organizational or community development, or to physician experiences—with evidence supporting their susceptibility to intervention (J. Humphreys et al., 2007; J. Rourke, 2008).

A total score for each cause of physician shortages is achieved by multiplying the sum of importance and severity by solvability: (importance + severity) x (solvability) (J. J. J. Hanlon & Pickett, 1990; Pineault, 1995). The causes of physician shortages are prioritized into four categories according to their total scores (Brousselle et al., 2011). Priority level 1 causes of physician shortages, shown in Table 3, are those that should be the first to target through policy intervention, followed by priority level 2 causes (Brousselle et al., 2011). Priority level 3 causes take precedence for further research, while level 4 causes are of secondary importance in terms of research (Brousselle et al., 2011). The results of this prioritization exercise serve to inform the final step in a strategic analysis, which involves analyzing the interventions to improve the geographic distribution of physicians, based on their ability to target priority interventions.

5.2.6 Results

Analysis of the causes

Table 4 presents the results of the analysis of the 26 causes of physician shortages. This table demonstrates that the "importance" of the causes ranges from a score of 4, for physician monopolies to a score of 52, for non-rural background and experience. A high importance score is indicative of both the volume and the strength of the evidence supporting the contribution of this cause to physician shortages in rural regions of OECD countries.

In terms of severity, three causes are scored a 10 for high severity: geographic isolation, poor infrastructure of rural regions, and non-rural background and experience. Harsh climate and lack of interest in primary care are the two causes that are scored a 5 for medium severity. The remaining causes receive a score of 0 for low severity. A low severity score means that although there is evidence to support the correlation between physician shortages and a cause, there is little evidence of an association between that cause and any of the other 26 causes of physician shortages. However, the opposite can be said about the five other causes, which either have a medium or a high severity score. These are factors that are found to cause other causes of physician shortages, that are associated with several other causes, and that figure in several causal chains. These may be considered some of the root causes of physician shortages in rural regions, and their higher severity score means they receive a higher overall priority for intervention.

In terms of solvability, 9 of the causes of physician shortages receive a score of 1 for "low solvability," including all of the causes categorized as professional trends, two of the community characteristics (those related to climate and geography), and two of those categorized under physician background and interests.

Table 4: Analysis of the causes of physician shortages in rural regions

Causes of physician shortages		Importance	Severity	Solvability	TOTAL
Professional trends	Aging population	19	0	1	19
	Global migration	21	0	1	21
	Increase of women in medicine	19	0	1	19
	Importance of a balanced lifestyle	27	0	1	27
Community characteristics	Harsh climate	23	5	1	28
	Geographic isolation	8	10	1	18
	High concentration of minority & low SES groups	24	0	1	29
	Poor infrastructure of rural regions	33	10	2	86
	Lack of community support for physicians	28	0	2	56
	Lack of spousal employment	25	0	2	50
	Lack of educational options for children	24	0	2	48
	Lack of leisure opportunities	21	0	2	42
Organization of medical practice	Inadequate health resources & physician supply planning	12	0	2	24
	Physician monopolies	4	0	2	8
	Poor rural medical practice infrastructure	37	0	2	74
	Inadequate incentive structures	32	0	2	64
	Lack of professional support for rural physicians	51	0	2	102
	Difficulty of rural medicine	31	0	2	62
	Lower ranking of rural medicine	26	0	2	52
	Lack of interest or experience in primary care	33	5	2	76

Physician background and interests	Distance from extended family and friends	15	0	2	30
	Non-rural background and experience	52	10	2	124
	Spousal non-rural background or disinterest in rural life	22	0	1	22
	Advantaged/non-minority background	12	0	1	12
	Lack of community service orientation	19	0	2	38
	Debt	11	0	2	22

Professional trends

The aging population of many rural areas receives an importance score of 19, and is "low" in severity, with its main influence being on the overall age of physicians and on the type of care required for an older demographic. An aging population is charged with reducing the overall supply of physicians, while increasing the demand for physician services (S. A. Cohen, 2009; Colwill et al., 2008; Crossley et al., 2009; Dumont et al., 2008; Pond & McPake, 2006).

Global migration, also referred to as "brain drain", and the increase of women in medicine, have importance scores of 21 and 27, respectively, while receiving low scores for severity and solvability. Designing strategies that would mitigate the effects of these wide-reaching trends on the geographic distribution of physicians is a potentially complex and costly exercise with questionable legal and social acceptability (Dauphinee, 2006; OECD, 2010; Phillips & Austin, 2009).

The importance of a balanced lifestyle, an important cause of physician shortages in rural regions, has an importance score of 27, but low severity and solvability scores. It is questionable whether balancing career, family, social life and leisure can be achieved in socioeconomically disadvantaged areas, or in regions with challenging environmental and infrastructural conditions (Lu et al., 2008; Ono et al., 2014). It is thought that the difficulty in retaining physicians in rural regions is due to differences in lifestyle, which have been "resistant to government policy" (Laurent, 2002). As with other large-scale social or professional trends, the increasing emphasis

on quality of life is generally considered "unmodifiable" (J. Humphreys et al., 2007; J. Rourke, 2008).

Community characteristics

The harsh climate in many rural regions has an importance score of 23, with medium severity. Extreme weather conditions and a vast terrain limit mobility and contribute to the geographic isolation of some rural areas (Felix et al., 2003; Kearns et al., 2006; Ono et al., 2014; J. Rourke, 2008). This, in turn, makes rural areas more difficult to service, leading to poor rural infrastructure and encouraging migration away from rural areas (OECD, 2010; Wilson et al., 2009; World Health Organization, 2010). Difficult living conditions lead to a lack of professional support in the rural healthcare system, and to the difficulty of rural medicine as a career choice (Dumont et al., 2008; Grobler et al., 2009). Harsh climate is considered "unmodifiable" and therefore has a solvability score of 1.

Geographic isolation is lower in importance, with a score of 8, but notably high in severity. The remoteness of some rural regions increases the chances of social isolation, due to the greater distances that must be traveled to visit family and friends, and professional isolation, due to the shortage of healthcare workers and the distance from research and development activities (Bilodeau et al., 2006; Curran et al., 2004; Kearns et al., 2006; World Health Organization, 2010). Geographically isolated regions are also more difficult to service, leading to infrastructural problems and driving migration to metropolitan zones (Dumont et al., 2008;

Kabene et al., 2006; Kearns et al., 2006; Ono et al., 2013). Many remote rural regions are characterized by a high concentration of minority groups, as well as socioeconomic challenges, contributing to a lack of employment, educational, and leisure opportunities (Laurent, 2002; Martinez et al., 2004; Pathman et al., 2004).

The high concentration of ethnic minorities, or groups of lower socioeconomic status has an importance of 24, and low severity. A number of studies refer to the "structural and institutional barriers" to healthcare delivery to disadvantaged populations, and to widespread institutionalized racism in the rural healthcare system (J. Humphreys et al., 2007; Laurent, 2002; Pathman et al., 2004). Providing medical care for aboriginal and minority groups, who may need tailored health education and community-based care, requires specialized training and may involve a "cultural brokerage" that some physicians perceive as difficult (J. Humphreys et al., 2007; Martinez et al., 2004; Pathman et al., 2004). Physicians who do not belong to a minority or disadvantaged group are less likely to express interest in community service, and are less likely to choose careers where they will be caring for the underserved (Porterfield et al., 2003; H.K. Rabinowitz et al., 2000; Wayne et al., 2010; Xu et al., 1997).

The poor infrastructure of rural regions has an importance score of 33, with a high severity score. This is consistent with the assertion that the underlying issue contributing to the shortage of physicians in rural regions is "the relative unattractiveness" of living and working in some rural regions (Ono et al., 2014). Experts suggest that the underinvestment in rural development is a "root cause" of the health disparities experienced by rural populations, with the

resultant economic decline described as the "slow death" of rural life (CSDH, 2008; Martinez et al., 2004). The lack of spousal employment, educational options for children, and leisure opportunities, and the migration of young people away from rural regions, are associated with this underinvestment and economic decline (Laurent, 2002). The poor infrastructure of rural regions is associated with higher rates of poverty, unemployment, and socioeconomic disadvantage (Pathman et al., 2004; Pong & Russell, 2003), and has multiple effects on the institutional decision-making and organization of rural health (Dumont et al., 2008; OECD, 2010; J. Rourke, 2008). The difficulty in securing professional support for physicians, and the overall difficulty and lower ranking of rural medical practice can be traced back to the under-development of basic services such as transport, telecommunications, water, electricity and housing, and a poor medical practice infrastructure, with a lack of tools, equipment, or opportunities for specialist consultation and professional development (Grobler et al., 2009; J. Humphreys et al., 2007; Martinez et al., 2004; Wilson et al., 2009). Studies suggest that financial, physical and sociopolitical barriers affect the "willingness of institutional level decision-makers" to invest in infrastructure and development of rural regions (Kearns et al., 2006; Ono et al., 2013).

The lack of community support for physicians and the lack of spousal employment are two important challenges related to the characteristics of rural communities, with importance scores of 28 and 25, respectively. Some studies suggest that community characteristics are the primary reason for physician shortages in rural regions, due to the differences in lifestyle (J. Humphreys, Wakerman, Pashen, & Buykx, 2009; Kearns et al., 2006; Laurent, 2002; J. Rourke, 2008). A lack of support from the community is a challenge to the recruitment of any kind of

professional support for rural physicians, adds to the difficulty of rural medical practice, and is an obstacle to finding employment for the physician's spouse (Felix et al., 2003; Veitch & Grant, 2004). A commitment from the community is a vital component for a sustainable model of rural medical practice (J. S. Humphreys et al., 2006). The severity of this cause is low, identical to the score for the lack of spousal employment, which creates additional financial and social challenges for the rural physician (Curran et al., 2004). Both of these contributors to physician shortages in rural regions can be addressed through community mobilization initiatives and regional recruitment strategies specifically tailored to "match" physician and community needs (Felix et al., 2003; Kearns et al., 2006; Veitch & Grant, 2004).

The lack of educational options for children and the lack of leisure opportunities are two characteristics of some rural regions, with importance scores of 24 and 21, respectively. The severity of both these causes is low, meaning that little evidence was identified of an association with other causes of physician shortages. One exception is the effect of these two factors on "brain drain" caused by the global migration of health professionals to where they will have access to a greater range of amenities (Dumont et al., 2008; Kabene et al., 2006). The solvability scores for both causes are indicative of possible regional development strategies that may mitigate the lack of educational and leisure options, but which are also costly due to the lack of economies of scale resulting from the low-density population of many rural regions (J. S. Humphreys et al., 2006; Kearns et al., 2006; OECD, 2010; Ono et al., 2013).

The organization of medical practice

The inadequate health resources and physician supply planning has one of the lowest scores of importance for its contribution to physician shortages in rural regions, at 12. However, studies emphasize the severity of situations where physician supply planning is unresponsive to the geographic distribution of health workers, to health service delivery contexts, and to the complexity of the variables affecting them (Bloor & Maynard, 2003; J. S. Humphreys et al., 2006; Ono et al., 2013). Some experts suggest that the effective management of physician supply to rural regions is a question of political will and policy commitment (Buykx et al., 2010; Pond & McPake, 2006; World Health Organization, 2010).

Physician monopoly on the provision of healthcare services in rural regions has the lowest importance score at 4, but low severity and high solvability. Physician monopolies can be a primary reason for the inadequate management of physician supply, and for the lack of professional support for rural medicine (Dussault & Franceschini, 2006; Zurn et al., 2004). Breaking down professional monopolies inevitably involves legal and political obstacles (Bloor & Maynard, 2003; Zurn et al., 2004).

The poor rural medical practice infrastructure, with an importance score of 37, is in part a result of the overall poor infrastructure in rural areas and of the lack of prioritization of primary care specialties and rural concerns (Dussault & Franceschini, 2006). Poor practice infrastructure is manifest in hospital closures, lack of adequate clinical facilities, and a lack of equipment, and

is a leading cause of the difficulty and lower ranking of rural medicine, as well as the resultant lack of professional support in rural areas (Curran et al., 2004).

The inadequate incentive structures associated with rural medicine has an importance score of 32, with low severity and high solvability. Existing incentive structures directly impair the ability to secure professional support for rural physicians, and add to the difficulty and lower ranking of rural medicine (Viscomi et al., 2013). The feasibility and acceptability of modifying these incentive structures from an economic, legal, and social standpoint is behind the high solvability score (Dolea et al., 2010; Ono et al., 2014; Sempowski, 2004; World Health Organization, 2010).

The lack of professional support for rural physicians has one of the highest importance scores, at 51, with low severity and high solvability. The lack of professional support is a driving force for the global migration of healthcare workers towards urban areas in search of a greater range of career opportunities and amenities (Dauphinee, 2006; Ricketts & Randolph, 2007; Simoens & Hurst, 2006). Working in isolation with no peer support means fewer opportunities for sharing workload and responsibilities or for guidance and mentorship, adding to the difficulty of rural medicine (J. Humphreys et al., 2007; Laurence et al., 2010; Quinn & Hosokawa, 2010; World Health Organization, 2010). The lack of other generalists or specialists negatively impacts the possibility for research involvement, which further lowers the ranking of rural medicine (Bilodeau et al., 2006; Leduc et al., 2011). Suggestions have been made to increase professional support to rural physicians through the use of nursing and allied health professionals, and

through the review of skill-mix and possible role substitutions within the health professions (Bloor & Maynard, 2003; Ono et al., 2014). Groups practices and "polyhealth" clinics have been set up in rural regions in several European countries but require significant startup costs and infrastructure development (OECD, 2010; Ono et al., 2014).

The difficulty and lower ranking of rural medicine are important professional practice issues, with scores of 31 and 26 respectively, found to be significant predictors of a physician's choice to forego rural medical practice (Curran et al., 2004; J. Humphreys et al., 2007). They are low in severity, affecting primarily the ability to secure professional support for rural physicians, with little else in terms of evidence of their association to other causes of physician shortages (J. Humphreys et al., 2007). Some studies have called upon medical schools to take a more active role in developing programs that would address health inequalities and prioritize rural community health needs (Murray et al., 2012; Ono et al., 2014).

Physician background and interest

A physician's lack of interest or experience in primary care has an importance score of 33, with medium severity and solvability, and is considered to be among the strongest predictors of future rural medical practice (Ono et al., 2014). Students who are interested in primary care at the outset tend to be more interested in community and humanitarian work and in caring for minorities and underprivileged populations (Hancock et al., 2009; Muller & Kase, 2010; Porterfield et al., 2003; Quinn & Hosokawa, 2010). Inversely, physicians who are interested in technological advances, medical innovation, or secondary/tertiary medicine are less likely to be

attracted to practicing in rural areas where there are limited physical facilities, fewer opportunities for research, and the expectation of solo work (Barnighausen & Bloom, 2009; Crump et al., 2004; Laurent, 2002; Ricketts & Randolph, 2007). Selecting students who are already interested in primary care specialties, or intervening to create interest among students, involves changes to the way medical schools have traditionally admitted students, and to the way medicine is taught (OECD, 2010; Ono et al., 2014).

The distance from family and friends is of lower importance, but is cited as one reason why some physicians are reluctant to work in rural regions (Crump et al., 2004; J. Humphreys et al., 2007). A low severity score indicates that there is little evidence of an association between the distance from loved ones and other causes of physician practice location. A high solvability score is indicative of a number of possible strategies that may facilitate visits to family and friends, and therefore help retain rural physicians to their practice location, such as providing financial reimbursement for transportation or improving rural infrastructure (Bilodeau et al., 2006).

A physician's non-rural background and experience has the highest importance score, at 52, with high severity and solvability. The association of rural exposure with the predictors of future rural medical practice are well documented (J. Humphreys et al., 2007; Laven & Wilkinson, 2003; Ono et al., 2014; J. Rourke, 2008; J. T. Rourke et al., 2005; World Health Organization, 2010). Rural exposure allows physicians the chance to "self-integrate" with the rural region, and to develop "a sense of place," an affective bond that drives greater community

engagement and resilience to adversity (Cutchin, 1997a; Hancock et al., 2009). Rural experience helps physicians manage their expectations about rural medicine, and develop a familiarity with and acceptance of the nature of rural medical practice (Manusov et al., 2010). Physicians who have a rural background tend to see rural communities in a more positive light, as regions offering a simpler, more peaceful, and less materialistic lifestyle, rather than one lacking in amenities (Bilodeau et al., 2006; Curran et al., 2004). Physicians of rural origin tend to have family, friends, and a community network within the region, and are more aware of—and better adapted to—the realities of life and work in a rural region (Hancock et al., 2009). Increasing the exposure of medical students to rural medicine and rural life is said to help alleviate physician shortages in rural regions (Chan et al., 2005; Ono et al., 2014).

A physician spouse's non-rural background or disinterest in rural life has an importance score of 22, but low severity and solvability. A spouse's background is thought by some researchers to be as important as the physician's own rural background (Chan et al., 2005; Felix et al., 2003; H. K. Rabinowitz et al., 2008; Ricketts & Randolph, 2007). However, a spouse's disinterest in the rural is associated only with the physician's own disinterest in rural medicine, indicating low severity (Avery et al., 2012; J. Humphreys et al., 2007; J. Rourke, 2008). The low solvability score for this cause is because policies targeting the spouse of a potential rural physician is regarded as falling outside of the realm of public health intervention (J. Humphreys et al., 2007; OECD, 2008).

The advantaged/non-minority background is the least important cause of physician

shortages, with a score of 12, low severity and low solvability. Individuals from privileged backgrounds are said to be less likely to express interest in rural medicine; on the other hand, affirmative action policies have been used in some countries to recruit individuals from disadvantaged backgrounds into medicine (Murray et al., 2012; Xu et al., 1997).

An individual's "humanitarian outlook," or experience in community service, is associated with an interest in rural medicine, with an importance score of 19 (Chan et al., 2005; Muller & Kase, 2010; Porterfield et al., 2003; Xu et al., 1997). The severity of this cause of physician shortages is low. Individuals who lack interest in community service tend to also express disinterest in primary care, and may have difficulty mobilizing community support as rural physicians (Avery et al., 2012; Quinn & Hosokawa, 2010). Attempts can be made to try to cultivate an individual's interest in community service, however, it is not well understood how this interest is brought about, hence the challenge of developing strategies to foster and maintain it over time (Hancock et al., 2009).

Although not one of the most frequently cited causes of physician shortages in rural regions, as evidenced by an importance score of 11, the amount of debt a physician has is scored low on severity, and is considered by many to be the most solvable. Relieving a physician's debt in exchange for rural service is a relatively straightforward and low-cost strategy to overcome some of the physician shortages in rural regions (Barnighausen & Bloom, 2009; Buykx et al., 2010; Dolea et al., 2010; Ono et al., 2014). On the other hand, not addressing debt can result in

more physicians foregoing rural medicine for urban specialties with highly controllable payment schedules (Hancock et al., 2009).

Prioritization of the causes

The causes of physician shortages are prioritized into four categories according to their total scores (Brousselle et al., 2011). Causes with a total score that is greater than 75 are considered top priorities. Second priority are causes with a score of 50–74. Causes with a score of 25–49 are third priority, while causes with scores of 0–24 are considered fourth priority. This is displayed in Table 5. Level 1 and 2 causes have high solvability scores and are considered top priorities for interventions (Brousselle et al., 2011). Top priorities for intervention include three community characteristics: the poor infrastructure of rural regions, the lack of community support for physicians, and the lack of spousal employment. Five characteristics are related to the organization of rural medical practice, including the lack of professional support for rural physicians, the poor rural medical practice infrastructure, the inadequate incentive structures, the difficulty of rural medicine, and the lower ranking of rural medicine. Finally, two relate to individual physician characteristics: non-rural background and experience, and lack of interest in primary care.

Professional trends, some community characteristics, and many of the individual characteristics of physicians associated with physician shortages in rural regions, are priority levels 3 and 4.

Table 5: Prioritization of the causes of physician shortages in rural regions

Priority Level	Cause of physician shortages	TOTAL
1	Non-rural background and experience	124
	Lack of professional support for rural physicians	102
	Poor infrastructure of rural regions	86
	Lack of interest or experience in primary care	76
	Poor rural medical practice infrastructure	74
2	Inadequate incentive structures	64
	Difficulty of rural medicine	62
	Lack of community support for physicians	56
	Lower ranking of rural medicine	52
	Lack of spousal employment	50
3	Lack of educational options for children	48
	Lack of leisure opportunities	42
	Lack of community service orientation	38
	Distance from extended family & friends	30
	High concentration of minority & low SES groups	29
	Harsh climate	28
	Importance of a balanced lifestyle	27
	Inadequate physician supply management	24
4	Spousal non-rural background or disinterest in rural life	22
	Debt	22
	Global migration	21
	Aging	19
	Increase of women in medicine	19
	Geographic isolation	18
	Advantaged/non-minority background	12

	Physician monopolies	8

5.2.7 Analysis

The prioritization exercise allows for a strategic analysis of the interventions to improve the geographical distribution of physicians in OECD countries, based on the degree to which each component strategy addresses the highest priority causes of physician shortages. Table 6 shows that overall, the interventions focus mostly on priority level 1 and 2 causes of physician shortages. We also observe that all of the high priority causes of physician shortages (priorities 1 and 2) are targeted by at least one, and up to five, intervention strategies. There are 10 causes that are not targeted at all, five that are priority level 3 causes, and six that are priority level 4 causes.

Table 6: Analysis of interventions to improve the geographic distribution of physicians in OECD countries

		Intervention type									
		Regulatory		Financial		Educational			Tailored		
Priority level		Trickle-down economics	Coercive measures	Targeting student	Targeting practicing	Selective admission	Curriculum changes	Rural medical schools	Community support	Professional support	Non-traditional services delivery
1	Non-rural background and experience		■	■	■	■	■	■			
	Lack of professional support for rural physicians		■		■		■	■		■	■
	Poor infrastructure of rural regions							■			■
	Lack of interest or experience in primary care		■	■	■	■	■	■			
	Poor rural medical practice infrastructure				■			■		■	■
2	Inadequate incentive structures				■						
	Difficulty of rural medicine				■		■	■	■	■	■
	Lack of community support for physicians							■	■		■
	Lower ranking of rural medicine			■	■		■	■			
	Lack of spousal employment								■		
3	Lack of educational options for children										
	Lack of leisure opportunities										
	Lack of community service orientation		■			■	■	■			
	Distance from extended family and friends				■						
	High concentration of minority and low SES groups					■					■
	Harsh climate										
	Importance of a balanced lifestyle										
	Inadequate health resources and physician supply planning										
4	Debt			■	■						

	Spousal non-rural background or disinterest in rural life									
	Global migration									
	Aging population									
	Increase of women in medicine									
	Geographic isolation									
	Advantaged/non-minority background									
	Physician monopolies									
	Number of causes targeted by intervention:	0	4	4	9	5	6	10	3	3	8

Setting up rural medical schools targets the greatest number of causes of physician shortages, for a total of 10 causes. This strategy also targets all of the priority level 1 causes. Financially targeting practicing physicians addresses nine of the causes of physician shortages, and four out of the five priority level 1 causes, while curriculum changes targets a total of six causes. Non-traditional services delivery targets six causes, while selective admission educational strategies target five. Controlling practice location through regulatory measures and financially targeting student physicians are strategies that each target four of the causes of physician shortages, while tailored community and professional support strategies can target three. Finally, regulatory policies involving centrally increasing physician supply are found to target none of the causes of physician shortages.

Regulatory interventions

Increasing physician supply

Increasing the supply of physicians to rural regions is sometimes thought to be best accomplished by increasing the overall number of individuals entering into the medical career path (Kirch et al., 2012). However, the economic assumption that the oversupply of physicians will "trickle down" to underserviced areas has been refuted in a number of studies (Bloor & Maynard, 2003; Matsumoto et al., 2010; Zurn et al., 2004). Physician supply forecasting models in most OECD countries are reportedly in need of review due to their limited ability to factor in analyses of healthcare labour trends (Dumont et al., 2008; Fournier, 2001; Kirch et al., 2012; OECD, 2008). The results of strategic analysis validate that regulatory interventions relying on trickle-down economics cannot be shown to respond to any of the causes of physician shortages in rural regions.

Controlling practice location

Regulatory interventions that obligate physicians to practice in a rural region for a number of years are thought to be disliked by physicians, and can be difficult to implement and enforce (Grobler et al., 2009; Wilson et al., 2009). Evidence suggests, however, that "coercive measures" can effectively fill rural physician shortages in the short-term (Ono et al., 2014; Simoens & Hurst, 2006). Table 4 shows that while not one of the strongest interventions in terms of addressing the causes of physician shortages, coercive measures can be directed at four of these causes: non-rural background and experience, lack of professional support, lack of interest in primary care, and lack of community service orientation. Rural origin or extensive exposure to

"the rural" is considered the best predictor for future rural medical practice (Ono et al., 2014). Several studies have noted a "dose-response" relationship between duration of exposure to a rural location and the likelihood of subsequently choosing a rural location for medical practice (Chan et al., 2005; Crump et al., 2004; G. Henry, 2003; J. Humphreys et al., 2007; Orzanco et al., 2011). Therefore, intervention strategies that can bring the physician to a rural region may improve the chances that this physician will later choose rural medicine as a career. Compulsory service in rural regions can result in a valuable learning experience serving disadvantaged communities, and a physician's greater appreciation for rural health concerns and for primary care medicine (World Health Organization, 2010). Mandating rural medical service is a comparatively low-cost solution to increasing professional support for rural physicians (Ono et al., 2014; Wilson et al., 2009).

Financial interventions

Contrary to regulatory interventions, financial interventions are seen as rewarding physicians for practicing in rural regions, rather than penalizing or coercing them (Ono et al., 2014; Wilson et al., 2009). Financial interventions have demonstrated positive results in improving the geographic distribution of physicians, but evidence of their long-term benefit is scarce (Grobler et al., 2009). They are considered less costly and require less planning and fewer human or infrastructural resources, so are relatively easy to implement (Ono et al., 2014; World Health Organization, 2010). Incentive structures are in need of review in order to: 1) offset the greater costs of rural medical practice, 2) adequately reflect the difficulty of the specialty and compensate for rural hardships, and 3) confer to rural medicine a symbolic value which would

elevate its status among the medical establishment (Bloor & Maynard, 2003; Grobler et al., 2009; J. Rourke, 2008).

Targeting student physicians

Table 4 shows that financial interventions may be successful in addressing the shortage of physicians in rural regions by targeting four causes of physician shortages in rural regions, including two top priorities for intervention: non-rural background and experience, and lack of interest in primary care. Medical students who are able to participate in scholarship or loans repayment programs in exchange for rural medical service are encouraged to consider rural medicine as a career option (Barnighausen & Bloom, 2009; Fournier et al., 2004). The experience of working in a rural region may dispel some of the negative stereotypes associated with rural medicine and stimulate students' interest in the field, and in primary care in general (Ono et al., 2014). Associating financial reward with rural medicine is a form of "institutional recognition" that can improve the lower ranking of rural medicine and draw attention to rural health concerns (Bilodeau et al., 2006; Ono et al., 2014). Finally, financial interventions are a relatively straightforward and quick method for relieving student debt, and eliminating this as a cause for not choosing rural medicine (Dolea et al., 2010; World Health Organization, 2010).

Targeting practicing physicians

This strategy addresses the causes of physician shortages in a similar manner to targeting

medical students, and according to the results in Table 4, targets an additional five causes of physician shortages. In Canada, Australia, New Zealand, Denmark, the US and the UK, financing is offered to support locum programs and on-call duties, and for hiring nurses or physician assistants, which targets the lack of professional support (Fournier et al., 2004; Kearns et al., 2006; Simoens & Hurst, 2006). Such programs also improve upon the deficiencies of the rural medical practice infrastructure, which can be circumvented to some extent through payment of expenses for medical equipment and the cost of continuing medical development, and by financing investments that encourage collaboration and coordination between health professionals, such as group practices or professional networks (Bourgeuil et al., 2006; Ono et al., 2014). Several countries, including Austria, France, Canada, the UK, Australia and the US, offer reimbursements for the setup costs of private practices (Simoens & Hurst, 2006). Financial strategies that "reduce the opportunity cost" of working in rural regions help alleviate some of the conditions contributing to the difficulty of rural medicine (World Health Organization, 2010). Financial interventions are also the only ones reviewed in this study that are found to be capable of correcting the inadequate incentive structure of rural medicine. Pay increases for rural physicians are implemented in a number of OECD member countries to reduce turnover in underserviced areas (OECD, 2008). In France, Canada and the UK, rural physicians are offered a variety of financial incentives to differentiate them from their urban counterparts; these incentives include annual guaranteed minimum income, higher capitation payments, or premiums for regions with low patient volume (Ono et al., 2014; Pong & Russell, 2003; Simoens & Hurst, 2006). This may improve the lower status of rural medicine. Finally, providing rural physicians with reimbursement for travel expenses to home and paid vacation are common financial intervention strategies that can help ease the distance from family and friends (Viscomi

et al., 2013).

Educational interventions

Selective admission

Studies demonstrate that medical school programs that grant preferential admission or offer pre-medical preparation to students based on a number of personal characteristics and interests associated with rural medical practice have shown evidence of long-term success in placing physicians into rural areas of shortage (Ono et al., 2014; H. K. Rabinowitz et al., 2011; Simoens & Hurst, 2006; World Health Organization, 2010). Selective admission strategies are most often directed at the non-rural background and experience of physicians as a cause of shortages, such as "rural pipeline" programs in Scotland and Japan that recruit students directly from rural high school for entry into medical school (Crump et al., 2004; Ono et al., 2014). In Canada, Australia, and the US, some medical schools screen for a student's interest or experience in primary care, which studies suggest is a "proxy" determinant—a necessary precursor for interest in rural medicine (Grobler et al., 2009; Pong & Heng, 2005; H. K. Rabinowitz et al., 2008). Other US interventions, such as the Rural Medical Scholars Program in Alabama, or similar interventions in Michigan and Missouri, screen for a student's "humanitarian outlook," while still other medical schools actively recruit students who have a demonstrated history serving the disadvantaged, overcoming the lack of community service orientation among medical students (Avery et al., 2012; Crump et al., 2004; Porterfield et al., 2003; Quinn & Hosokawa, 2010). Selective admission strategies are unique in their ability to target rural areas with a high concentration of minority and/or low SES groups, as well as students from disadvantaged

minority groups. Canada and Australia also have rural pipeline medical programs, such as University of Manitoba's Northern Medical Unit, which targets Aboriginal students for premedical preparation, and Australia's Flinders University, which specifically targets Indigenous Australians, a visible minority group that is underrepresented in medical careers (Avery et al., 2012; Curran et al., 2004; Murray et al., 2012).

Curriculum changes

In addition to recruiting students who are most likely to choose rural medicine, some medical schools have made changes to the way medicine is taught, in an effort to create an interest in rural medicine (Grobler et al., 2009). Curricula that integrate clinical sciences with health and social sciences and embed students early on in community and local clinics rather than in a university and hospital setting, provide students with the type of hands-on experience that can increase their interest in primary care, in rural medicine, and in community service (Curran et al., 2004; Murray et al., 2012). These strategies therefore target the non-rural background and experience of medical students, their lack of interest in primary care, and their lack of a community service orientation. Some medical schools in Canada, Australia, the US and Belgium have adopted a "whole school" approach to medical curricula, which emphasizes creating partnerships with health system personnel and producing graduates with locally relevant competencies (Murray et al., 2012). This approach can achieve much in improving the lower ranking of rural medicine. By facilitating collaboration with community leaders and other health professionals, the lack of professional support that is often reported for rural physicians may be lessened (Grobler et al., 2009). This can also be achieved by having faculty and personnel who are especially designated for a rural medicine program (Murray et al., 2012). Exposure to rural medicine both in the theoretical and practical sense allows physicians to acquire the broad skill

set necessary to later practice medicine in a rural setting, thereby overcoming some of the difficulty of rural medicine (World Health Organization, 2010). Studies show that medical students who enroll in a primary care focused curriculum that is community-oriented and problem-based are more likely to work in underserved areas than those who follow a conventional medical curriculum (Grobler et al., 2009; Simoens & Hurst, 2006).

Rural medical schools

Establishing medical schools, satellite campuses, or "polyhealth" clinics in rural regions is the third strategy of educational interventions, and another step in the rural pipeline approach. It is also one of the costliest intervention strategies, since it involves an investment in infrastructure (OECD, 2010; Ono et al., 2014). However, evidence suggests that establishing medical schools in rural regions is one of the most effective strategies in improving the geographic distribution of physicians, since it prolongs their exposure to "the rural," increasing the likelihood of a "dose-response" relationship and the resultant retention of the physician in the rural region (J. Humphreys et al., 2007; Orzanco et al., 2011). This approach also minimizes "leaks" in the rural pipeline: urban exposures that can entice rural students (Crump et al., 2004). In this sense, rural medical schools target the non-rural background and experience of medical students, their lack of interest in primary care, and their lack of a community service orientation by immersing students in rural living and primary and community medicine. Rural medical schools, with their faculty, staff, and professional and community networks, can greatly improve upon the lack of professional support reported in rural regions (Ono et al., 2014). Being part of a dedicated institution can lessen the difficulty of rural medicine, since physicians are not expected to

automatically transfer the skills acquired through a conventional urban medical education to the rural setting, where advanced technology, equipment, and specialized support may be unavailable (World Health Organization, 2010). This would also improve the lower ranking of rural medicine, since a rural medical school would eliminate, or greatly reduce, comparisons to urban practice and expectations by urban teachers and staff that can undermine a student's rural inclination (Curran et al., 2004; Dolea et al., 2010; Pong & Heng, 2005; J. Rourke, 2008).

Establishing medical schools in rural regions is an exceptional strategy for improving the geographic distribution of physicians, because other than the specifically tailored interventions, it is the only strategy that can address two of the most important and most difficult to solve causes of physician shortages: the poor infrastructure of rural regions, and their geographic isolation. A campus or clinic strategically placed in a rural or remote region can widely disperse medical services to geographic areas that had previously been hard to reach (OECD, 2010). This renders these regions less isolated, effectively "medicalizes" the region, and improves upon the surrounding infrastructure (OECD, 2008; Wilson et al., 2009). Such is the case of the Northern Ontario School of Medicine (NOSM) in Canada, which distributes medical training to over 70 teaching and research sites across Northern Ontario, and which has demonstrated positive results in keeping graduates in rural regions (Ono et al., 2014). Developing rural infrastructure has a natural effect on the poor medical practice infrastructure of rural regions. A locally-established physical structure of a health setting brings more medical equipment, technology, and human resources, for better practice conditions (OECD, 2010; World Health Organization, 2010). Finally, where research, training and partnerships are established between medical schools and local health systems, community engagement is necessary and emphasized, which can help

overcome the lack of community support that is sometimes reported by rural physicians (Crump et al., 2004; World Health Organization, 2010).

Tailored interventions

These are strategies that are tailored to the unique characteristics of a specific rural region or of an individual physician. Their strength is that they can be used in an intermittent fashion to target causes of physician shortages that may not be addressed by other interventions. Studies have emphasized the importance of incorporating various support strategies in interventions to increase the retention of physicians in rural regions, but these strategies are the least frequently implemented, and are rarely documented (Grobler et al., 2009; Ono et al., 2014; World Health Organization, 2010).

Community support

This intervention strategy targets the lack of community support for rural physicians by directing mobilization and development activities at both the incoming physician and the hosting rural community. The Southern Rural Access Program (SRAP) in the US supports rural communities in recruiting a physician who is "the right fit" for their needs, and provides technical assistance towards the enhancement of local capacities (Felix et al., 2003). Programs in Australia, Canada and the US offer community mobilization activities to build networks between incoming physicians and key community members (Bourgeuil et al., 2006; OECD, 2008). Some interventions focus on offering "health and well-being" support by linking physicians to relevant

community resources (Wakerman et al., 2008). Many of these activities can help relieve some of the difficulties of rural medicine. Finally, tailored community support interventions are the only ones to offer the possibility of addressing the lack of spousal employment, as some OECD member countries have measures in place to assist spouses in identifying job opportunities (OECD, 2008).

Professional support

These intervention strategies are directed towards the lack of professional support for rural physicians, and most commonly include measures to encourage collaboration and coordination between rural health professionals and to facilitate the creation of professional networks (OECD, 2008). Some countries have introduced "model practices" in rural regions, which, by organizing the delivery of healthcare services among multidisciplinary health teams, allow for better and more flexible work conditions and reduce the difficulty of rural medicine (Ono et al., 2014). Professional support measures may also help to overcome some of the problems associated with the poor rural medical practice infrastructure that come with solo medical practice, such as the lack of opportunities for consultation, research and professional development (Ono et al., 2014).

Non-traditional services delivery

These interventions attempt to circumvent the shortages of physicians in rural regions by delivering healthcare services either through traveling clinics or through the use of telemedicine. For example, programs in Canada and in Australia overcome the lack of professional support for

physicians by arranging for specialists to travel intermittently to regions that are too remote, or where the population base is too small, to establish tertiary services (Ono et al., 2014; Pong & Russell, 2003; World Health Organization, 2010). Many OECD countries are investing in improving broadband capacity in rural regions in order to effectively use advanced technology (OECD, 2010; Ono et al., 2014). This is one step towards improving the rural medical practice infrastructure. Using web services or video conferencing, a rural physician can connect to other physicians and health professionals, which reduces professional isolation (OECD, 2010; Ono et al., 2014). This also helps reduce the difficulty of rural medicine, and the repercussions of geographic isolation. Studies suggest that telehealth networks in Canada have improved access to healthcare in Aboriginal communities, who are able to receive generalist and specialist consultations as well as patient education through this intervention (Pong & Russell, 2003). This suggests that non-traditional health service delivery can be appropriate for remote areas with a high concentration of minority and low SES groups. In Germany, rural physicians can conduct "virtual visits" with patients and communicate patient information using e-health equipment. A digital platform was established to cut down on commuting time for home visits, especially for chronically ill patients (OECD, 2010). Such a strategy may be an effective approach to providing healthcare to an increasingly aging population.

5.2.8 Discussion

This research demonstrates that establishing medical schools in rural areas is the intervention strategy that addresses the greatest number of causes of physician shortages in rural regions, and the greatest number of priority levels 1 and 2 causes. Financial interventions

targeting practicing physicians is a close second. The third greatest number of causes are targeted by non-traditional services delivery methods, which are also able to target all priority levels. These results are displayed in Table 7. Two other educational interventions, namely curriculum changes to include rural content and training and the selective admission to medical schools of students with a demonstrated rural background or experience, are the most effective intervention strategies for addressing the causes of physician shortages in rural regions.

Table 7: Ranking of interventions and targeted causes

Intervention strategy	Total number of targeted causes	Priority level 1 causes	Priority level 2 causes	Priority level 3 causes	Priority level 4 causes
Rural medical schools	10	5	3	1	1
Target practicing physicians	9	4	3	2	0
Non-traditional services delivery	8	3	2	1	2
Curriculum changes	6	3	2	1	0
Selective admission policies	5	2	0	2	1
Target medical students	4	2	1	1	0
Coercive measures	4	3	0	1	0
Community support	3	0	3	0	0
Professional support	3	2	1	0	0
Trickle-down economics	0	0	0	0	0

Overall, educational interventions are most effective in addressing the causes of physician shortages in rural regions of OECD countries. Financial incentives are most effective in mitigating the causes of physician shortages when they target already practicing physicians. Medical students accrue greater benefit from educational strategies than from financial ones, particularly as evidence suggests an important selection bias among students who participate in "return-of-service" incentive schemes, in other words, these students would have chosen rural placements anyway (Barnighausen & Bloom, 2009; Grobler et al., 2009; Wilson et al., 2009). Regulatory interventions that employ coercive strategies may effectively target important causes of physician shortages, but are disliked by both physicians and administrators (Grobler et al., 2009; Ono et al., 2013; Wilson et al., 2009). Based on our findings, community and professional support strategies target fewer causes of physician shortages than all other interventions, yet the causes they do target are all high priority ones. Finally, the *laissez-faire* regulatory strategy of allowing market forces to dictate the geographic distribution of physicians has not been shown to address any of the causes of physician shortages.

Another major finding of this research is that the causes of physician shortages are not equal in importance, nor do they each contribute equally to the shortage of physicians; also, some causes of the problem are more difficult to solve than others. This study reveals that there are 10 priority areas for intervention: 1) the non-rural background of most physicians, 2) the lack of professional support for rural physicians, 3) the poor infrastructure of rural regions, 4) the lack of interest in primary care, 5) the poor medical practice infrastructure in rural regions, 6) the inadequate incentive structures for rural medicine, 7) the lack of community support for rural physicians, 8) the difficulty of rural medicine, 9) the lack of spousal employment, and 10) the lower ranking of rural medicine. Half of these causes are related to the way rural medicine is

organized and health services administered. The rest relate to the characteristics of rural communities and the personal situation of the physician. Therefore, it is questionable whether interventions that focus solely on changing the behavior of physicians, without considering the influence of organizational or community factors, can bring about improvements to physician shortages in rural regions.

An examination of the interventions that have been implemented in OECD countries demonstrates that it is possible to mitigate the causes of physician shortages through a judicious selection of intervention strategies, customized for the needs of each country and each region. Policymakers can focus on the causes of physician shortages that are most significant in their particular context, and can select the intervention or combination of strategies that are most effective in resolving them. Alternatively, this research presents a framework for a critical assessment of interventions that are already in place by revealing whether, and how, they address the reasons for physician shortages. Most importantly, this research demonstrates that the persistence of physician shortages in rural regions of OECD countries cannot be attributed to the failure of interventions to address the causes of physician shortages.

This study is the first to prioritize the interventions to improve the geographic distribution of physicians based on their ability to address the causes of the shortages. Prioritization exercises have been used in the medical field to rank health problems, and in management to rank both problems and solutions, but this is the first time that this method is used to rank *the causes* of a problem and to inform a causal analysis (Baltussen & Niessen, 2006; Viergever, Olifson, Ghaffar, & Terry, 2010). Strategic analysis, although not new, is a relatively underdeveloped

evaluative approach in the area of health and social services, so validation of the approach would be a useful addition to the field. A parallel development to strategic analysis in the field of evaluation is referred to as contribution or causal analysis, which explores the question of causation when there are multiple contributory factors influencing a particular outcome (J. Mayne, 2001; John Mayne, 2012). Contribution analysis deals with an intervention as being part of a "causal package," which is a combination of causal factors, some related to the actual intervention, others to concurrent interventions, as well as the events and conditions external to the intervention, that make a difference in whether or not an intervention will achieve its intended objective (John Mayne, 2012).

Another significant development in public health research that is worth noting as part of a discussion of strategic analysis is in the area of structural interventions in healthcare. Structural interventions locate the causes of public health problems in contextual factors in the physical, social, political, and economic environments, rather than in the characteristics of individuals (Blakenship, Friedman, Dworkin, & Mantell, 2006; Lieberman, Golden, & Earp, 2013). Structural approaches are theoretically consistent with the literature on the social determinants of health, which postulates that addressing socioeconomic conditions is the most effective way to improve population health (D. A. Cohen, Scribner, & Farley, 2000; Lieberman et al., 2013). Structural interventions, therefore, aim to have an impact on multiple levels through the design of "multidimensional packages" of interventions (Blakenship, Bray, & Merson, 2000). The idea that structural interventions are more effective is consistent with the underlying premises of strategic analysis: that interventions must target the factors that cause the problem, across levels, and that being situated at various levels, these factors do not contribute equally to the problem.

This research covers a wide range of interventions and documented causes of physician shortages. In return for a broad scope of analysis, the level of detail of discussing specific interventions is reduced. We present a composite of the interventions and of the causes of shortages in OECD countries, but we do not evaluate specific interventions within their specific contexts. Evaluation of specific interventions—for example, the educational interventions implemented at the Université de Montréal's Faculty of Medicine—would allow for the validation of strategic analysis as an evaluative approach.

5.2.9 Conclusion

We set out to understand whether the shortage of physicians in rural regions of OECD countries persists because of the failure of interventions to adequately address the causes of physician shortages. This research demonstrates that the most significant documented reasons that physicians do not choose rural medical practice can be surmounted by employing one, or a combination of, intervention strategies that have already been implemented across a number of OECD member countries. Most of the interventions are designed, explicitly or implicitly, to target a number of the causes of physician shortages, and can be considered relevant to the problem at hand. The persistence of physician shortages in rural regions of OECD countries cannot be attributed to the lack of relevance of the interventions.

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5.3 Article 4: A logic analysis of interventions to increase the number of physicians practicing in rural regions

Alya Danish, François Champagne, Régis Blais

Abstract

A persistent problem of physician shortages in rural and remote regions across Organisation for Economic Cooperation and Development (OECD) member countries has led to the development of regulatory, financial, educational, and tailored interventions designed to increase the number of physicians practicing medicine in rural and remote regions. However, studies of the effectiveness of interventions present weak or inconclusive results. The interventions are said to be designed with no recourse to scientific evidence. The purpose of this study is to evaluate the plausibility of the interventions. A logic analysis allows for the construction of a conceptual framework for the interventions based on a critical review of theories of work motivation. Based on these theoretical constructs, logic models present a visual display of the functional mechanism of the interventions. Evaluating the interventions through the lens of logic analysis is achieved by comparing the functional mechanism of interventions to the theories of work motivation. This research demonstrates that educational strategies are intrinsic in nature and are the only interventions that can plausibly instill motivation in physicians for rural medical practice. Financial and tailored interventions are extrinsic in nature, so while they may drive physicians to choose rural medicine, they can only motivate if they are combined with educational strategies or when they contain motivating components. Regulatory interventions are found to demotivate physicians for rural medicine. Logic analysis demonstrates that to improve the retention of physicians to rural regions, motivating strategies are needed;

while extrinsic interventions can help recruit physicians to rural regions, they will not achieve long-term retention.

5.3.1 Introduction

An imbalance in the geographic distribution of physicians has been reported in most of the industrialized world. According to the OECD, physicians tend to cluster around metropolitan centres, leaving rural regions at a disadvantage in terms of accessing essential healthcare services (OECD, 2010; Ono et al., 2014). Physician shortages are recognized as an impediment to the achievement of improved health status and overall health equity, therefore, most OECD member countries have devised a number of interventions to increase the number of physicians practicing in rural regions (Ono et al., 2014; World Health Organization, 2010). Interventions can be grouped into four categories: regulatory, financial, educational, and tailored interventions, which provide community or professional support measures. Despite the wide range of interventions, few examples exist of effective, long-term solutions (OECD, 2010; Ono et al., 2014).

5.3.2 Problem description

The majority of interventions to increase the number of physicians practicing in rural regions are designed on the basis of a traditional human resources management approach (Bourgeuil et al., 2006; Dolea et al., 2010; Lehmann et al., 2008; World Health Organization, 2010). This approach attempts to outline the factors behind the *recruitment* and *retention* of the

physician to rural regions (World Health Organization, 2010). *Recruitment* is described as the motivation to fulfill the initial attraction to the rural region by practicing in that location; *retention* is the motivation behind the deliberate choice to stay or to leave the rural region, after having experienced, and having gained a full awareness of, the conditions of living and working there (Bilodeau et al., 2006).

Understanding the motivation behind a physician's choice of practice location, and how to influence it in favor of rural regions, stands out as the fundamental basis of interventions to increase the number of physicians practicing in rural regions. Yet, the lack of success in resolving physician shortages in rural regions has been attributed to the weakness of the interventions, which are described as lacking basis in scientific evidence (Dolea et al., 2010; Dussault & Dubois, 2003; Dussault & Franceschini, 2006; Lehmann et al., 2008; Ono et al., 2014; Wilson et al., 2009; World Health Organization, 2010). Numerous publications have called for a critical examination of the theoretical basis of interventions, to explain how exactly they are supposed to work (L. Chen et al., 2004; Dieleman et al., 2011; Dussault & Dubois, 2003; J. Humphreys et al., 2008; Lehmann et al., 2008; Wakerman et al., 2008; Wilson et al., 2009).

5.3.3 Logic Analysis

Logic analysis is a type of program theory evaluation that examines the theoretical foundation of interventions. It is thought that if an intervention is well implemented, but does not produce the intended outcome, then either the theory behind the intervention is faulty, or the

intervention is not founded in theory at all, and has been designed instead on the basis of inaccurate perceptions espoused by stakeholders and policymakers (Brousselle et al., 2009; Tremblay et al., 2013).

(H. T. Chen & Rossi, 1983) were among the first to advocate for theoretically-driven approaches to evaluation; they argued that a lack of attention to social science theory when designing social programs has led to poorly conceptualized interventions that are based on a distorted understanding of causal mechanisms. (Weiss, 1972) emphasized the importance of detailing a program's theory as a necessary precursor to evaluation, and for understanding the relationship between a program's objectives and its proposed method for attaining these objectives (Brousselle et al., 2011). More recently, (Donaldson, 2003) proposed that the plausibility of an intervention's functional mechanism must be tested against existing theories and research, even before a full evaluation can be undertaken. Logic analysis is also referred to as program theory, outcome pathway, action theory, or *theory of change*—a term that has recently gained traction in the evaluation literature and refers to the modelling of interventions to understand how they are meant to work (John Mayne, 2015).

The importance of logic analysis is three-fold (Brousselle et al., 2011). First, logic analysis reveals the adequacy of an intervention; in other words, it reveals whether the planned activities and processes of the intervention, as well as the resources allocated to the intervention, can conceivably achieve the intervention's intended results. Second, logic analysis determines the intervention's potential for evaluation. If an intervention is unfounded, or its underlying

theoretical assumptions implausible, then evaluating it may be unnecessary or infeasible. Third, logic analysis sheds light on the effectiveness of an intervention. An implausible intervention theory is likely to be at the root of an intervention's ineffectiveness.

5.3.4 Objectives

This chapter examines the criticism that the interventions to improve the geographic distribution of physicians are theoretically unfounded. The objective of this research is to use logic analysis, a form of program theory evaluation, to analyze the interventions based on the validity of their underlying theories.

5.3.5 Methods

There are three steps for conducting a logic analysis (Brousselle et al., 2011). The first step is to develop a conceptual framework, in this case a knowledge synthesis of work motivation theories that represents evidence of the best way to achieve the declared objectives of the interventions. The second step is to build the logic model of the interventions. The third and final step is to analyze the intervention theory by comparing existing interventions to theories of work motivation. The objectives of each intervention, along with details about the proposed activities and their objectives, as well as the expected outcome of the intervention, are visually represented in a way that displays the links between the various components. This allows for an adequate understanding of how the intervention is intended to achieve the desired outcome.

Logic analysis relies on published research as a primary source of evidence for evaluating the validity and adequacy of the theories underlying intervention programs (Brousselle & Champagne, 2011). Logic analysis compares program theory, or if this is not explicit, then the implemented intervention, to scientific knowledge or expert advice (Brousselle & Champagne, 2011; Brousselle et al., 2011).

To accomplish this, a literature review on the theories of work motivation was performed with the use of Google Scholar. The key words "theories of motivation" and "work motivation" were used. Reviews of theories of work motivation were selected, as were publications that provided general overviews of the theories, or frameworks, for work motivation. A second search was performed to identify and select publications addressing Frederick Herzberg's two-factor theory. A snowballing of citations in PubMed provided additional sources of literature specific to the health and medical fields.

5.3.6 Results

The conceptual framework

Understanding motivation facilitates the prediction of workplace behavior, and is important for managing change and resistance in the work setting (Gagne & Deci, 2005; Grant & Shin, 2011; Locke & Latham, 2012). Motivation governs people's actions, the effort they put into these actions, and their persistence in their chosen behaviors (Ambrose & Kulik, 1999; Grant & Shin, 2011; Johns, 2006). A motivated individual is someone who is "energized and activated"

towards an end, while an individual who "feels no impetus or inspiration to act" is considered unmotivated (Ryan & Deci, 2000).

There are two principal types of work motivation theories, those that focus on intrinsic motivation and those that deal with extrinsic motivation (Gagne & Deci, 2005; Grant & Shin, 2011; Steers, Mowday, & Shapiro, 2004). Intrinsic theories of motivation posit that people engage in an activity because they find it interesting or derive some kind of satisfaction from it (Gagne & Deci, 2005; Johns, 2006). The nature of motivators is examined relative to the internal psychology of the individual (Bassett-Jones & Lloyd, 2005; Grant & Shin, 2011). Extrinsic theories of motivation posit that motivation is determined by contingencies outside of the person's individual psychology (Gagne 2005). External factors, usually stemming from the work environment and applied by someone other than the person being motivated, are the inducers of action (Locke & Latham, 2012).

The fundamental question of how to motivate people to work has led scholars in the field of motivation research to propose a number of theories and integrative models (Johns, 2006; Latham & Pinder, 2005). Herzberg's two-factor theory provides a general integrative framework for understanding work motivation. Along with the needs theories of Maslow (1954) and Alderfer (1972), Herzberg's work is considered a classic in organizational behavior (Gagne & Deci, 2005).

Two-factor theory rests on the idea that there are two sets of human needs: the first is the

drive to avoid pain and to satisfy basic biological needs, and the other is related to the ability to achieve, and to experience psychological growth through achievement (Herzberg, 1968). (Herzberg, Mausner, & Snyderman, 1959) proposes that there are also two categories of factors related to work motivation: factors that are extrinsic to the job itself, found in the work environment and in the *job context*, and factors that are intrinsic to the work itself, which are inherent to the job and related to *job content*. These factors are outlined in Table 8.

Table 8 : Factors affecting work motivation (Herzberg et al., 1959)

Intrinsic Factors	1. **Achievement:** success or failure, seeing the results of one's work, solutions to problems 2. **Recognition:** acts of notice, praise, blame or criticism 3. **The work itself:** job as a source of good or bad feelings, varied/routine, easy/difficult, interesting/boring work 4. **Responsibility:** a person's authority vs. that required to do the job, authority over one's or others' work 5. **Advancement:** when an actual change, rather than a potential for one, occurs on the job 6. **Personal growth:** evidence that possibilities for growth, improved job status, or skills advancement are increased or decreased
Extrinsic Factors	1. **Administrative policies:** adequacy/inadequacy of organization & management, employee expectation vs. reality 2. **Supervision:** competence, fairness, willingness to teach and designate responsibility, or lack thereof 3. **Interpersonal relationships:** the characteristics of interactions with superiors, peers, and subordinates 4. **Work conditions:** amount of work and physical conditions like facilities, lighting, ventilation, tools, space, etc. 5. **Salary:** compensation, wage 6. **Status:** change in social or professional rank affecting feelings for the job 7. **Security:** presence or absence of job security, tenure, or company stability 8. **Personal life:** aspects of job affecting family needs, or family problems stemming from the job

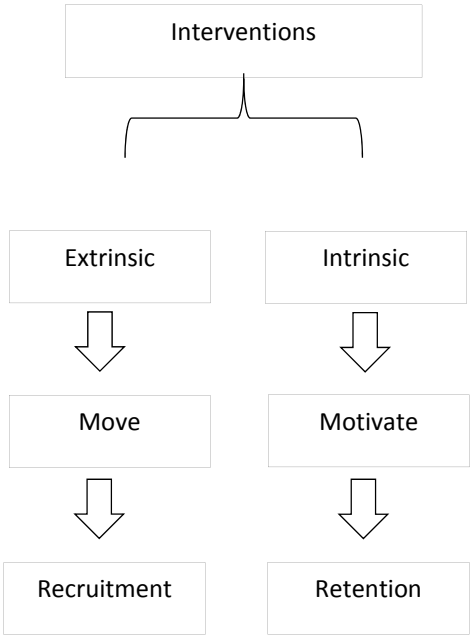
Motivation for a job is the result of the job content, which intrinsically motivates individuals to choose to do the work, and the job context, which extrinsically *moves* individuals to work. The distinction between motivation and movement is an important tenet of the two-factor theory. Extrinsic factors can lead to "no dissatisfaction" with the job, whereas motivation is achieved through intrinsic factors (Herzberg, 1968). Intrinsic factors sustain effort on the job, while extrinsic, or "hygiene factors," lead to dissatisfaction when they are inappropriate (Bassett-Jones & Lloyd, 2005; Gagne & Deci, 2005). Motivating factors involve psychological growth, while hygiene factors involve physical and psychological pain avoidance (Sachau, 2007). Thus, the factors involved in producing motivation are separate and distinct from the factors that lead to job dissatisfaction (Herzberg, 1968).

Another major tenet of the two-factor theory is the idea that the intrinsic factors for work motivation are additive, while the extrinsic factors are not (Ryan & Deci, 2000). This means that improvements in more than one intrinsic factor will bring about greater motivation, whereas the same statement cannot be made about hygiene needs. Some researchers suggest that sources of dissatisfaction interact negatively with, and undermine, intrinsic motivation (Gagne & Deci, 2005). Others add that hygiene factors have an "escalating zero point," which means that people will always been chasing better rewards and incentives. Motivational researchers argue that long-term motivation for a job cannot be achieved through extrinsic factors alone, yet it cannot be achieved as long as hygiene needs are denied (Sachau, 2007).

Based on a reading of the theories of motivation and on the two-factor theory, the

conceptual framework for the interventions to increase the number of physicians practicing in rural areas is represented in Figure 3. Interventions are either extrinsic in nature, moving physicians to choose rural regions and useful in recruitment activities, or they are intrinsic in nature, motivating physicians for rural medical practice and important for the retention of physicians in rural regions.

Figure 3: Conceptual framework for the interventions to recruit and retain physicians in rural regions



The logic models of interventions

This section presents the logic model for each of the interventions implemented in OECD countries to improve the geographic distribution of physicians, in Figures 4–7. The models are a visual representation of the functional mechanism of the interventions, in light of the work motivation theory-based analysis. The models display the intended objective of each intervention strategy, its proposed activities, the output of the intervention, and the final intended result, which is that physicians establish rural medical practice.

Figure 4: Logic model for regulatory interventions

Figure 5: Logic model for financial interventions

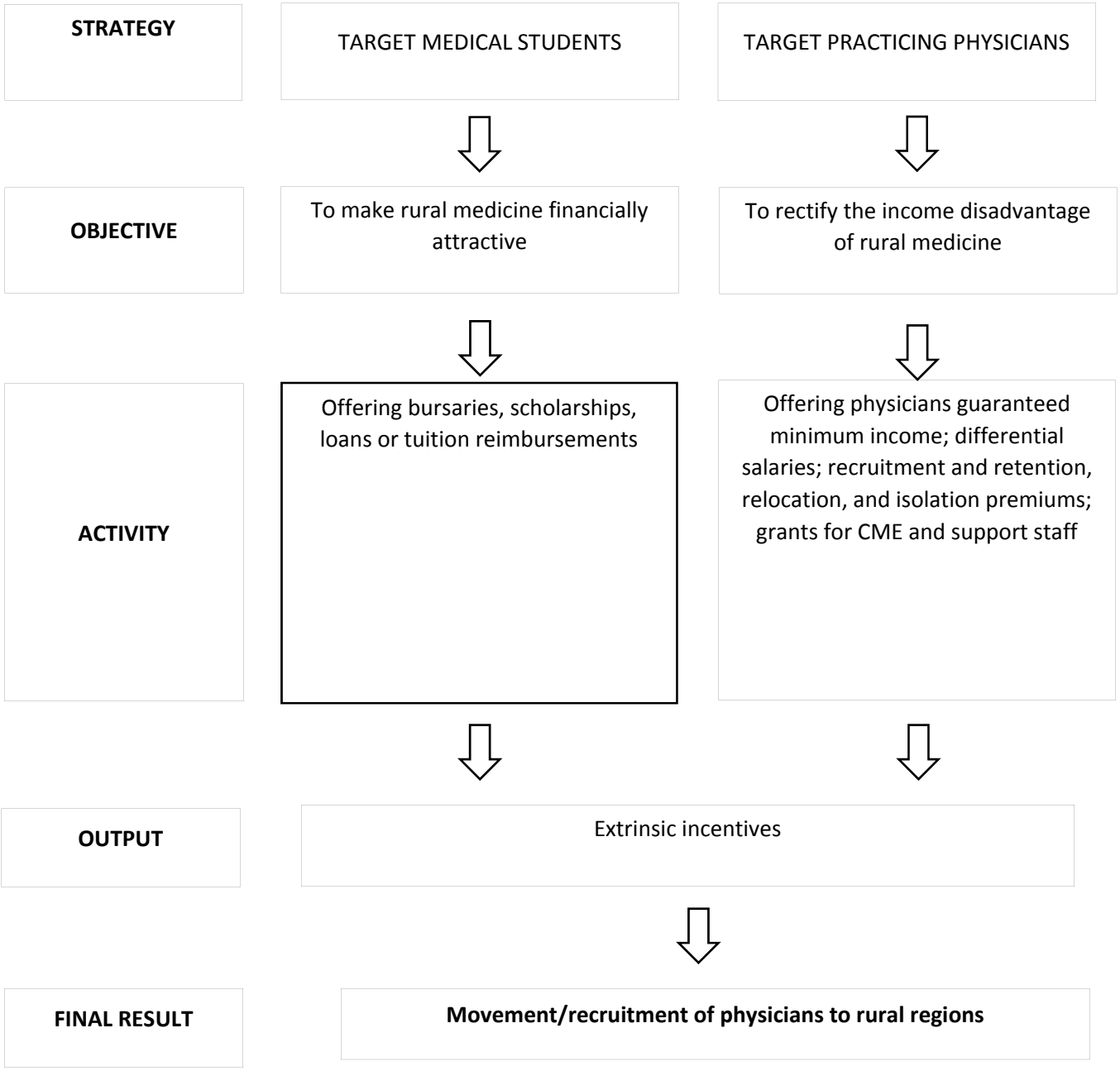


Figure 6: Logic model for educational interventions

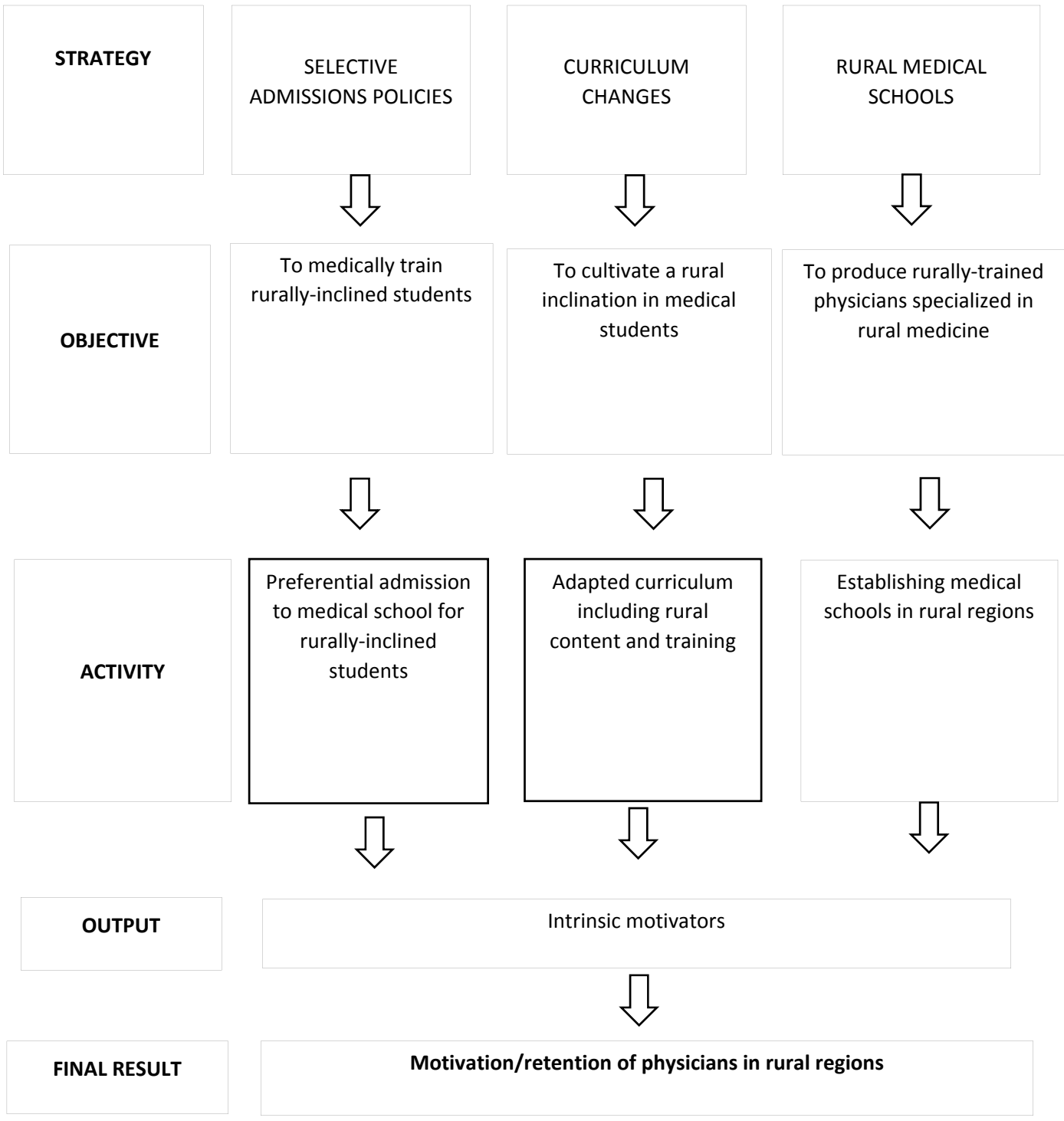
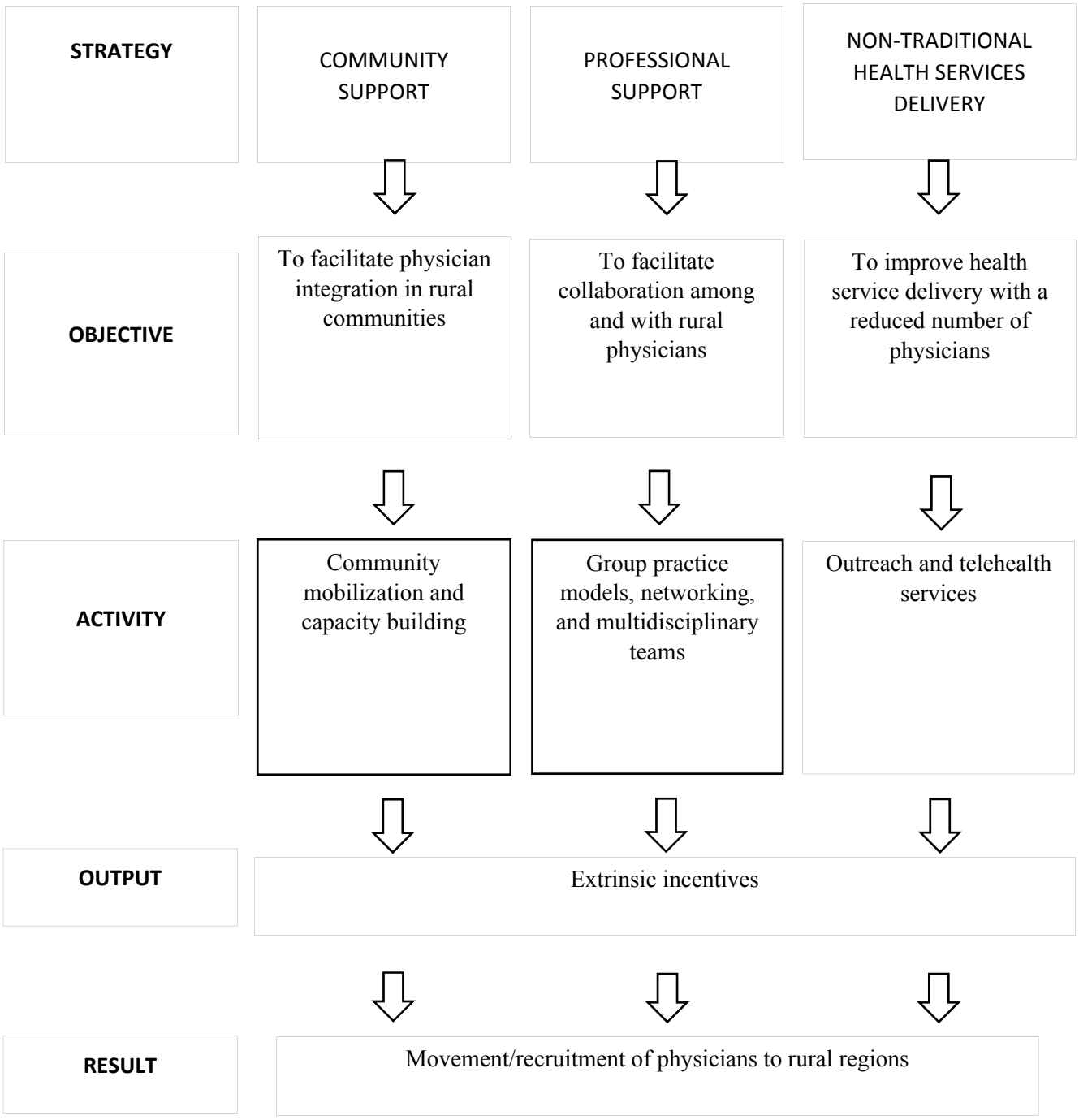


Figure 7: Logic model for tailored interventions



Analysis of intervention theory

Regulatory interventions

Regulatory interventions are implemented by governments, medical schools, or professional bodies, using health workforce planning models, which evaluate the existing number of practicing physicians relative to population density, and forecast future demand for physician services (Ono et al., 2013). Regulatory interventions are comprised of two strategies; the first have been described as "coercive" or "penalizing" in nature because physicians are not choosing rural medical practice voluntarily (Ono et al., 2014; Pong & Russell, 2003; Wilson et al., 2009; Zurn et al., 2004). This is accomplished by increasing quotas for entry into medical schools and/or residencies in order to increase the inflow into the medical profession, and thus the overall supply of physicians. The objective of this strategy is to increase competition for urban jobs (Bloor & Maynard, 2003; Matsumoto et al., 2010; Simoens & Hurst, 2006). The objective of the second strategy is to decrease or eliminate the availability of urban jobs by mandating temporary rural placements for new physicians, by restricting quotas for urban "vacancies," or by providing billing numbers only for rural regions (Ono et al., 2014; Simoens & Hurst, 2006). The assumption underlying regulatory strategies is that the increased competition for urban jobs, or their decreased availability, will drive physicians to seek work opportunities in undersupplied areas, namely rural regions.

Regulatory interventions alter the job context and work environment, so can be said to employ extrinsic strategies to achieve their objective. Using *disincentives*, or sanctions, to make physicians service rural and remote regions is a neoclassical approach to motivation that sees

people refusing to work unless they are forced to do so (Delfgaauw & Dur, 2005). According to two-factor theory, negative incentives do not lead to motivation, only to movement in the best of cases (Herzberg, 1968). Movement is a function of the fear of punishment, or the fear of not receiving extrinsic rewards (Herzberg et al., 1959). So, while a "kick in the pants"—a common approach used in behavioral modification and animal training—may be successful in forcing a worker to do a job, this does nothing to instill motivation for the job. This is because, according to Herzberg, motivation is a function of growth from getting *intrinsic* rewards out of interesting and challenging work (Herzberg, 1968). Regulatory interventions can increase dissatisfaction and have a negative effect on motivation.

Centrally increasing physician supply, with the intention that the increased competition for urban patients will lead to a "trickle-down" effect that will push physicians to "undersupplied" rural regions, is a strategy that has a negative impact on both the intrinsic and extrinsic factors involved in work motivation. Increasing overall physician supply is considered a harmful regulatory strategy by some physician associations, as well as a direct threat to income potential (Bloor & Maynard, 2003). Flooding the market with physicians threatens their *job security*. Evidence suggests that after evaluating their relative utilities, physicians still prefer areas of social advantage and opportunity, despite the increased competition for jobs (Bourgeuil et al., 2006).

The increased competition for patients in urban areas may give physicians what (Herzberg et al., 1959) refers to as "objective evidence" that possibilities for *personal growth* within this

career are now decreased; this may result in the unintended effect of driving physician relocation to other wealthy, but less competitive jurisdictions, rather than to rural regions (Matsumoto et al., 2010). In Germany, one effect of regulatory strategies has been to discourage students from studying medicine in favor of other subjects (Bourgeuil et al., 2006).

Controlling practice location, the second regulatory strategy, can fall under harmful *administrative policies* according to Herzberg's definition, and it has been shown to increase job dissatisfaction (Ono et al., 2014; Wilson et al., 2009). Restrictions on urban practice may be disruptive for a physician's *personal life*, while mandatory rural practice may be impossible, especially if there are familial or social barriers to relocation (Wilson et al., 2009). This strategy negatively impacts the intrinsic factors for motivation. Most physicians are unprepared for the difficulties and particularities of rural medicine, especially considering that it is newly graduated medical students who are most often the recipients of coercive regulatory measures (Grobler et al., 2009; Wilson et al., 2009). Mandatory rural placement can therefore be a source of negative feelings towards the *work itself* (Buykx et al., 2010; Curran et al., 2004). Rural medical practice requires different skills and training than specialty medicine and urban practice (Grobler et al., 2009). Physicians who are unprepared for rural work may perceive their *personal growth* as being negatively affected because of the disruption to their skills advancement or career progression. Studies suggest that controls on physician practice location are also considered an affront to the autonomy and authority of an independent professional, negatively impacting a physician's sense of control and *responsibility* for his or her work (Wilson et al., 2009). In Canada, reports suggest that physicians are choosing to opt out of the public healthcare system altogether, billing patients privately rather than submit to practice restrictions (Dumont et al.,

2008; Pong & Russell, 2003). Most OECD countries have thus abandoned coercive regulatory policies, deeming them unconstitutional (Ono et al., 2014; Simoens & Hurst, 2006).

Financial interventions

Financial interventions take the form of incentives that *target medical students* or *target practicing physicians* in exchange for practice in rural regions (Barnighausen & Bloom, 2009; Grobler et al., 2009; World Health Organization, 2010). Medical students may be offered bursaries, scholarships, loans, or tuition reimbursements. Practicing physicians may benefit from guaranteed minimum income, differentiated salaries, or a choice of payment methods. They may also receive recruitment and retention premiums, relocation grants, continuing education grants, funding schemes for locums and support staff, isolation premiums and on-call premiums. The assumption behind financial interventions is that monetary incentives will motivate medical students or physicians to choose rural medical practice (Barnighausen & Bloom, 2009; Wilson et al., 2009). The objective of financial interventions is to make rural medical practice a financially attractive career choice, and to rectify the perceived income disadvantage of rural medicine (Ono et al., 2014; World Health Organization, 2010).

According to the two-factor theory, using financial rewards such as spiraling wages or fringe benefits to motivate workers drives them to constantly seek the next wage increase and to consider rewards as rights (Herzberg, 1968). Herzberg insists that while inadequate compensation will dissatisfy an employee, beyond a minimum threshold money does not motivate people to work (Bassett-Jones & Lloyd, 2005).

Financial interventions are considered extrinsic incentives that can move medical students or physicians to accept rural jobs. Financial interventions *targeting medical students*, such as scholarships and tuition reimbursements offered in return for rural service, function most obviously by increasing *salary*. Financial interventions are a welcome *administrative policy* that compensates for some of the sources of dissatisfaction faced by physicians in rural regions and encourages them to accept novel and challenging work arrangements (Bloor & Maynard, 2003; World Health Organization, 2010).

Our analysis reveals that there are some mechanisms by which financial interventions may positively influence motivation for rural medicine by improving upon a medical student's sense of *achievement*, and by providing opportunities for *personal growth* with the rural medical profession. Evidence suggests that students who participate in a bonded service agreement, where they receive scholarships, bursaries or loans in return for temporary rural service, are more likely to choose rural medical practice (Barnighausen & Bloom, 2009; Grobler et al., 2009; Ono et al., 2014). Fulfilling a bonded service agreement is "the successful completion of a job," which according to the two-factor theory, allows medical students to see the results of their efforts, lending them a sense of achievement (Herzberg et al., 1959). Financial strategies can improve intrinsic motivation for rural medicine by enhancing *personal growth*. Bonded service agreements allow medical students to gain experience in rural health problems and rural research; they also allow them to develop their skills in community medicine and ambulatory care, thereby developing autonomy and confidence in rural medical practice (Curran et al., 2004; Gagne & Deci, 2005). In such cases, financial strategies can provide "objective evidence" that

there is a potential for growth within rural medicine, resulting from skills advancement and from potential job opportunities in rural regions (Herzberg et al., 1959).

Targeting rural physicians, financial interventions also increase *salary*, an extrinsic factor to prevent dissatisfaction (Herzberg et al., 1959). Monetary assistance for setting up practice and for tools and equipment helps to enhance the physical work environment, while grants for hiring locums or support staff alleviate the workload, thereby improving the overall *work conditions* associated with rural practice (Ono et al., 2014; Simoens & Hurst, 2006). Evidence suggests that physicians who remain in rural regions cite monetary rewards among their top reasons for staying (Barnighausen & Bloom, 2009; Dunbabin et al., 2006; J. Rourke, 2008; Sempowski, 2004; Viscomi et al., 2013). Financial interventions are therefore positive *administrative policy*.

Practicing physicians may additionally derive motivational benefit from financial incentives. Guaranteed minimum incomes and the various bonuses and incentives offered to encourage physicians to establish private practice in rural regions may give them a sense of "vindication from seeing the value of one's work," a positive factor for *achievement* (Herzberg et al., 1959; Ono et al., 2014). By offering rewards unique to rural physicians and attainable only through rural service, financial interventions can distinguish rural medicine in comparison to urban medicine, which can further motivate the career choice (Locke & Latham, 2012; Steers et al., 2004). The range of premiums made available for rural physicians for recruitment, relocation, retention, and isolation are thought to be an important form of institutional *recognition* for the inherent challenges of rural medical practice (Bilodeau et al., 2006; World Health Organization,

2010). Acts of notice or praise have a positive effect on intrinsic motivation for a job (Herzberg et al., 1959). Finally, financial incentives for rural physicians often cover costs of continuing medical education, travel to conferences, and hiring support staff—strategies that provide "objective evidence" that there is a potential career projection within rural medicine, thereby enhancing *personal growth* (Ono et al., 2014).

Educational interventions

Educational interventions aim to instill the inclination for rural medical practice and rural life as early as possible in a student's medical career (Ono et al., 2014). Three strategies, selective admission policies, curriculum changes, and rural medical schools, can be used singularly or in combination to attempt to reach the intervention objectives. Studies suggest that individuals who possess a rural background—for example, those who grew up in a rural region, who have lived or worked in one, or who express an interest in rural medicine and rural life—are more likely to choose a career in rural medicine (Avery et al., 2012; Dolea et al., 2010; Orzanco et al., 2011; Quinn & Hosokawa, 2010; Wayne et al., 2010). The assumption underlying educational interventions is that building on a student's background and interest favors a positive future attitude towards "the rural," dispels negative stereotypes, and minimizes the possibility of "urban disruption," which is defined as the exposure to urban medicine and life that may result in a shift away from rural values and interests (Curran et al., 2004; Ono et al., 2014; Pong & Heng, 2005; Wilson et al., 2009).

Selective admission policies grant preferential admission to medical school to students with rural backgrounds or to those who express interest in rural medicine. The objective of selective admission strategies is to medically train students who possess the rural inclination, as evidenced by rural background or interests (Ono et al., 2014; World Health Organization, 2010).

Curriculum changes involve modifying medical school training programs to include rurally-focused content, internships, clinical rotations, and specialties. The objective of curriculum changes is to cultivate an interest and a background in rural medicine and rural life among medical students. This is done by attempting to instill a "rural inclination" through early and repeated exposure to rural medicine and rural life (Curran et al., 2004; Grobler et al., 2009; Ono et al., 2014; Pong & Heng, 2005).

Rural medical schools, the third educational intervention strategy, refers to on-site rural medical education where medical schools, satellite campuses, or clinical training sites are established in rural regions. The objective of rural medical schools is to produce physicians who are rurally-trained and specialized in rural medicine. Locating medical schools in a rural setting and immersing medical students in rural life is thought to enhance their engagement with their host community and their attachment to it (OECD, 2008). This strategy attempts to preserve an already existing rural inclination evidenced by a student's application and acceptance of admission into a rural medical school (J. Humphreys et al., 2007; Ono et al., 2014; Pong & Heng, 2005; H. K. Rabinowitz et al., 2008)

Logic analysis reveals that educational interventions directly target the factors that are intrinsic to the work of rural medicine; they are inherent to the job itself and related to the job content. Educational interventions are also able to intervene upon some of the extrinsic factors of rural medical practice that may lead to dissatisfaction.

Selective admission strategies

These interventions target students who have a rural background and/or have expressed an interest in rural medicine. These strategies arguably intervene upon individuals who are already intrinsically motivated for the work itself, and attempt to foster and develop this motivation. Some experts argue that rural inclination is the only variable associated with an increased likelihood of entering rural practice upon graduation (Pong & Heng, 2005; H. K. Rabinowitz et al., 1999). This assertion is supported by two-factor theory, which posits that it is this intrinsic motivation, referred to in this case as "rural inclination," that can bring about high performance in employees, and feelings of love, pride, and attachment to their work (Herzberg, 1968).

Selective admission strategies develop intrinsic motivation for rural medical practice through the recognition of students' origin and experience. Preferential treatment may constitute an act of notice or praise, which validates students' background and interests and motivates them to invest effort into the rural medicine career path (Grant & Shin, 2011; Herzberg et al., 1959). This is done by promoting rural medicine as an attainable career choice for students of rural origin (Avery et al., 2012; Dolea et al., 2010; Pong & Heng, 2005; Wayne et al., 2010).

Students from rural areas are more likely to come from lower socioeconomic backgrounds, which may prohibit them from considering a career as a physician (Dhalla et al., 2002; World Health Organization, 2010). Selective admission policies help to overcome this exclusion. Programs such as the Alabama Rural Health Leader Pipeline Program pair students with career counselors who help them develop the academic and social skills necessary for admission into medical school (Avery et al., 2012). Some may only have access to lower-level secondary education, which may prohibit qualifying for medical school (Curran et al., 2004; Pong & Heng, 2005; World Health Organization, 2010). Selective admission into a rural pipeline medical education program represents a significant career advancement, which according to Herzberg, describes when an actual change has already taken place (Herzberg et al., 1959). For many, admission to medical school is a validation of one's efforts as a student, and represents an academic achievement that may have previously been less accessible (Dhalla et al., 2002; Herzberg et al., 1959).

Selective admission policies are also found to influence some of the factors for extrinsic motivation. In Canada, Manitoba's Northern Medical Unit and Ontario's Northern Ontario School of Medicine target Aboriginal students and offer them tutorials in premedical subjects and various forms of community-focused educational support (Curran et al., 2004; Pong & Heng, 2005). A positive approach to supervision—a "willingness to teach" demonstrated by the mentoring of rural students—is an example of a selective admission strategy that is also able to improve upon a number of extrinsic work factors that decrease satisfaction with rural medicine (Herzberg et al., 1959). Many of these policies enable students to develop positive interpersonal

work relationships through regular interaction with mentors and peers (Avery et al., 2012; Wayne et al., 2010). A number of selective admission policies prioritize greater involvement of rural community members and the local medical community, in order to foster a better sense of connection and integration between the and medical students (N. Hanlon et al., 2010). Selective admission policies can thus be considered favorable and beneficial administrative policy for potential rural physicians, since it is an improvement in the organization and management of the rural medicine admissions process (Herzberg et al., 1959).

Curriculum changes

Evidence demonstrates that rural-based training and skills enhancement increases students' interest in rural practice and the likelihood of subsequently choosing to practice medicine in a rural region (Dunbabin et al., 2006; Grobler et al., 2009; World Health Organization, 2010). By increasing rural content in the medical curriculum and including training on-site, students are given the opportunity to develop confidence and self-efficacy in rural medicine and rural living (Johns, 2006; Steers et al., 2004). This improves student's sense of responsibility, which according to Herzberg, takes place when the gap between a person's authority to do a job and the authority required to actually do the job is decreased (Herzberg et al., 1959).

Curriculum changes can improve student motivation for rural medicine by targeting the *work itself*, making it more manageable, less difficult, and a source of positive feelings (Herzberg et al., 1959). Rurally-focused training exposes students to the career options and to the

various forms of support that may be available to them in the rural context (Ono et al., 2014). Reports from participants in Australia's Flinders University's Parallel Rural Community Curriculum (PRCC) program confirm an increased access to rural patients, clinical learning opportunities, and community resources in a rural setting (Walters et al., 2003; World Health Organization, 2010). Recognizing that they can achieve their work-related goals in rural medicine improves physician motivation for choosing it as a career (Grant & Shin, 2011). Curriculum changes can therefore be seen to positively contribute to *personal growth,* because students have the opportunity to associate positive career and life outcomes to rural medicine (Johns, 2006; Latham & Pinder, 2005).

Curriculum changes are strategies that can also intervene upon the "hygiene factors" by removing some of the sources of dissatisfaction with rural medical practice. Similar to selective admission strategies, the local availability of mentors, trainers, and supervisors is thought to be a critical component of this intervention (World Health Organization, 2010). Establishing relationships with rural mentors and peers reduces the chances for dissatisfaction with a job (Bassett-Jones & Lloyd, 2005; Herzberg, 1968). Positive factors for extrinsic motivation include competent, willing, and available *supervision* in the workplace (Herzberg et al., 1959).

Establishing beneficial *interpersonal relationships* in the workplace can also be accomplished by targeted changes to medical education and training. Reflecting the rural context in educational content equips students with the necessary skills and competencies to collaborate with rural communities and manage their health needs within the particular conditions of practice

in rural areas (World Health Organization, 2010). This exposure to rural life and work can reduce students' negative expectations of practice in rural areas (Ono et al., 2014). Strategies that lessen "the gap between employee expectations and reality" are the definition of positive *administrative policy* (Herzberg et al., 1959). Medical curricula development and modification that increases student exposure to rural life and work allows them to internalize rural values in alignment with intervention objectives (Grant & Shin, 2011).

Rural medical schools

Students who choose to attend a rural medical school likely harbour fewer negative expectations about rural medicine and rural life, and may have chosen rural practice anyway, without intervention (Grobler et al., 2009). These students have arguably already demonstrated some intrinsic motivation for the work itself. They may also be intrinsically motivated by the awareness of a potential for personal growth as a rural physician. This "continuity of place" experienced in a rural-based learning environment is associated with finding purpose and meaning in work, and with a greater attachment to "profession and place" (Crump et al., 2004; N. Hanlon et al., 2010). Rural medical schools, such as Japan's Jichi Medical University and Norway's University of Tromso, have been shown to foster interest in rural medicine through uninterrupted exposure to rural practice and rural life (Curran et al., 2004; Grobler et al., 2009; Ono et al., 2014; Pong & Heng, 2005). Maintaining education in a rural region reduces the possibility of "urban disruption," described as opportunities for exposure and comparison with urban culture and medicine that can have a negative influence on attitudes towards the rural, resulting in a shift toward urban values (Crump et al., 2004; Curran et al., 2004).

Place-based education that is grounded in the local community nurtures intrinsic motivation because students can see the relevance of what they are learning; there are several studies demonstrating enhanced student participation in community matters as a result (Powers, 2004). Recognizing one's role in the local health system and being able to see "solutions to problems" enhances a student's sense of achievement and improves intrinsic motivation for rural medical work (Herzberg et al., 1959). An approach of social accountability in medical education that addresses health inequalities and delivers "people-centered health care" was identified by the WHO in as early as 1995; it still continues to gather momentum, particularly within the context of addressing the rural-urban gradient in health care access (Murray et al., 2012; World Health Organization, 2010). Rural medical schools espousing this approach can increase a student's sense of responsibility, authority, and competence to do the job. Prolonged immersion in the rural context allows students the opportunity to internalize and/or reinforce rural values (Grant & Shin, 2011). Immersion, combined with local guidance and supervision, exercises the greatest influence on enhancing the specialized skills and competencies necessary for rural medicine (Wilson et al., 2009).

Rural medical schools have a positive influence on a number of extrinsic factors involved in work motivation. Effective rural programs build mutually reinforcing relationships between universities and health services, whereby students receive locally relevant teaching (Murray et al., 2012). Providing specialized instruction demonstrates increased competence in rural medicine and a willingness to teach rural practice, which according to two-factor theory, improves supervision (Herzberg et al., 1959). Rural medical schools help to build positive

interpersonal relationships between students, their peers, and their superiors. Immersing students in the rural environment allows them to "grow roots," and facilitates the development of personal and professional networks (World Health Organization, 2010). A community-integrated rural medical education creates social and cultural capital among participating physicians by instilling an appreciation of, and a commitment to, collegiality as a professional value deemed necessary for success in rural medical practice (N. Hanlon et al., 2010). Studies consistently show that community relationships are important influences on the career satisfaction of rural physicians (J. Humphreys et al., 2007).

Interventions that affect an employee's feelings for the job by modifying professional status or rank are seen as targeting the extrinsic factors for motivation (Herzberg et al., 1959). One advantage of rural medical schools is that they eliminate unfavorable comparisons with urban medical practice, thereby removing an important source of dissatisfaction with rural medicine (Grant & Shin, 2011; Johns, 2006). Finally, establishing medical schools or localized clinics in rural regions involves an investment in the development of rural and medical infrastructure in the region (OECD, 2008). This serves to "medicalize" rural areas, contributing to the development of their health systems (OECD, 2008; Wilson et al., 2009). By building physical facilities and investing in equipment and technology, rural medical schools improve upon the work conditions associated with rural medical practice.

Tailored interventions

Tailored interventions vary between OECD countries to suit the context of a given region,

but generally take the form of one of three strategies: community support, professional support, and non-traditional services delivery, as depicted in Figure 7.

Community support strategies, sometimes referred to as "golden hellos," are designed to 1) encourage collaboration between the physician and the community,2) facilitate the physician's integration into the community, and 3) assist with spousal employment and children's educational options (Bourgeuil et al., 2006; Dieleman et al., 2011). This may be accomplished through a variety of activities such as the mobilization of community leaders to receive new physicians, linking physicians to community support networks, organizing teambuilding activities, developing community strategic plans for health, funding capacity-building initiatives, and providing technical assistance (Buykx et al., 2010; J. Humphreys et al., 2008; Veitch & Grant, 2004; World Health Organization, 2010). The assumption underlying this intervention strategy is that physicians are more likely to establish practice in a rural region if the local community is welcoming of them. Based on the results of systematic reviews of effective retention strategies for physicians in rural regions, ensuring social, family, and community support is a core component of a comprehensive retention strategy for rural physicians (Buykx et al., 2010; Grobler et al., 2009).

The second tailored intervention strategy offers rural physicians *professional support* through the establishment of professional networks, group practices, multidisciplinary health teams, task sharing models, or skill-mix initiatives. The objective of professional support strategies is to facilitate collaboration among rural physicians and with other healthcare

professionals (Ono et al., 2014; World Health Organization, 2010). The assumption underlying professional support strategies is that they will motivate physicians to choose to practice in rural regions.

The third and final tailored intervention strategy aims to secure healthcare for rural and remote populations through *non-traditional services delivery*, including outreach services in the form of traveling clinics or telemedicine. The idea behind these strategies is to separate medical service provision from the location of the patient, or to "make do" with available resources in very remote regions (OECD, 2010; Ono et al., 2014; World Health Organization, 2010). The underlying assumption is that physicians are not motivated to establish practice in rural regions. The objective of this strategy is to improve healthcare services with a reduced number of physicians.

Tailored intervention strategies employ extrinsic factors for work motivation. They are generally designed to target specific sources of dissatisfaction with rural medical practice in a specific context, but logic analysis reveals that tailored interventions can also target some of the intrinsic factors affecting work motivation by altering aspects of the nature of rural medical practice.

Community support strategies improve a physician's *interpersonal relationships* by facilitating relationships with community leaders and regional health authorities, which, as studies have shown, are strategies that improve job satisfaction (World Health Organization,

2010). Evidence suggests that physicians do make use of community support activities when they are offered, and they are less likely to report physical and mental health problems compared to before community interventions were offered (Dieleman et al., 2011). Some community initiatives also improve *work conditions* for incoming physicians. By mobilizing key community members, some rural regions are able to engage in infrastructure development and capacity building, which contribute to improving the local quality of healthcare (Wakerman et al., 2008; World Health Organization, 2010). *Administrative policy*, defined as the perception of an adequate management and organization of the work context, is one of the extrinsic factors of Herzberg's two-factor theory (Herzberg et al., 1959). Some community support initiatives, such as the Regional Recruiter Strategy implemented across the Southern US, have shown success and a relative ease of implementation; this has led the federal government to adopt certain components of the program for a federal initiative to increase physicians in underserved areas (Felix et al., 2003). Community support strategies can have a positive effect on *administrative policy*.

Selecting a physician for recruitment to a community is an act of *recognition*, which is a positive factor for intrinsic motivation. Rural regions that involve community members, including local government representatives, special interest groups, and active individuals in the assessments of local health needs and in the recruitment and retention of physicians have reported positive outcomes (Felix et al., 2003; Veitch & Grant, 2004). From the perspective of Herzberg's two-factor theory, community involvement in recruiting physicians whose needs "match" those of the rural region can make the chosen physician feel special, which can increase motivation to practice in that community (Johns, 2006). Community support strategies, which

facilitate collaboration between community members and the local physician, can have the effect of enhancing the physician's sense of *responsibility* towards the community. Physician inclusion in health planning activities and involvement in regional health needs assessment efforts can augment the knowledge, competencies, and authority required for the rural physician to successfully do the job (J. Humphreys et al., 2008; Viscomi et al., 2013). Case studies from Canada, Australia and the US recount an alternate scenario, where new physicians are actively rejected when there is a mismatch between their needs and the needs of the community (Cutchin, 1997b; Ono et al., 2014; Wakerman et al., 2008).

Professional support strategies can alleviate some of the sources of dissatisfaction by targeting extrinsic factors for work motivation. Interventions that help rural physicians to establish beneficial professional linkages target *interpersonal relationships*. Reports from France, Germany, Canada and Switzerland assert that rural physicians are increasingly seeking opportunities for group practices or for work in community health centers, which allow better working conditions and higher work satisfaction than solo practices (Ono et al., 2014). Primary healthcare in rural regions requires a broad skill set that many physicians find challenging, therefore, the inclusion of non-physician clinicians to relieve some of the workload is a recommended initiative (Dubois & Singh, 2009; OECD, 2008; Pong & Russell, 2003). Mechanisms that allow rural physicians to reduce time on-call, or to take weekends off, go a long way to reduce burnout, and as some studies show, reduce the number of rural physicians who want to leave their practice (World Health Organization, 2010). This would improve rural physicians' *personal lives*, because they would have more time to devote to personal and family needs (Herzberg et al., 1959). One such program is "Dr DOC," which was implemented in

Australia in 2006, and provides a number of support mechanisms for rural physicians, including country practice retreats, crisis support, and a visiting general practitioner to provide health care for the rural physicians and their families (World Health Organization, 2010). Professional support programs consistently rank among the most valued intervention programs to rural health workers (Dolea et al., 2010). When they improve upon the organization and the management of rural practice, they may be considered beneficial *administrative policy*.

Professional support strategies relieve some of the workload facing rural physicians, improve productivity, and are said to reduce the incidence of stress and burnout (Dubois & Singh, 2009; OECD, 2008; Ono et al., 2014; Pong & Russell, 2003). Some studies show that physicians are wary of the difficulty of rural medicine, particularly of working in isolation without recourse to other health workers (Bilodeau et al., 2006). Professional support strategies can improve physician feelings about the *work itself*, by making rural practice more manageable, such as when collaboration with other generalists and specialists, opportunities for research, and professional networks are facilitated. Multidisciplinary health teams, task sharing, and skill-mix models have been introduced in a number of OECD countries as a retention strategy for rural physicians (OECD, 2008; Ono et al., 2014). Finally, professional support strategies may enhance a physician's sense of *responsibility*, which is a positive intrinsic factor for motivation. Offering professional support to rural physicians may enhance their feelings of competence and self-efficacy (Grant & Shin, 2011; Johns, 2006). This would be an added assurance that they have the required "authority" to be the community health provider. In a supportive work environment, people may internalize the values and attitudes of their work context, so that "external regulators" of work behavior are no longer required, meaning physicians may become

intrinsically motivated toward rural medical practice (Gagne & Deci, 2005; Grant & Shin, 2011).

Non-traditional services delivery strategies are less about enhancing the rural medical practice experience, and more about removing some of the barriers to delivering physician services in rural regions. By eliminating the need for physicians to be permanently on-site, some of the extrinsic barriers to rural medical practice are also eliminated. Removing the sources of dissatisfaction related to working conditions makes employees more likely to accept their jobs, even if they are not intrinsically motivated to do so (Herzberg, 1968). For example, a Fly in/Fly Out program in Australia has "remote relievers," physicians who will tour outlying remote areas for only a few days, followed by a fixed number of days off that are spent in their home location (Ono et al., 2014). Non-traditional services delivery means that physicians can better maintain their professional networks and overcome the sense of being "cut off"; it also counters the perception that rural medicine limits future career options and development (Bilodeau et al., 2006; Dussault & Franceschini, 2006; J. A. Henry et al., 2009). A study of a telehealth initiative in Eastern Quebec, Canada, demonstrates how the technology decreases feelings of isolation, and gives physicians access to meetings with specialists and opportunities for consultation with peers (Gagnon, Duplantie, Fortin, & Landry, 2007). Non-traditional services delivery strategies can thus remove the dissatisfaction with rural work that stems from the lack of professional interpersonal relationships. These strategies may also reduce some of the most common stressors to a rural physician's personal life, as they do not have to spend long periods of time away from extended family and friends, which is a major deterrent for physician retention in rural regions (Viscomi et al., 2013). By using outreach mechanisms, or telehealth, physicians can avoid the heavy workload and constant on-call that comes from being a rural community's sole healthcare

provider (Buykx et al., 2010). They can thus devote more time to family, friends, and other lifestyle factors (Bilodeau et al., 2006; Laurence et al., 2010).

Finally, non-traditional services delivery strategies, particularly when they employ technological advances, are slowly changing the face of rural healthcare delivery by providing health care, health resources, and health education through electronic information and communication technologies (Toh, Pawlovich, & Grzybowski, 2016). These strategies have the potential to change the definition of rural medicine, and the nature of *the work itself*. Few studies have explored the implications of non-traditional services delivery strategies on the factors that affect intrinsic work motivation, but some motivation theorists argue that jobs that are unique and relatively difficult encourage the development of "novel task strategies," or new ways of accomplishing the job, which increase motivation and improve performance (Gagne & Deci, 2005; Grant & Shin, 2011; Steers et al., 2004). Innovative healthcare delivery mechanisms may reframe what it is to be a rural physician, likely for the better, as early evidence suggests (Gagnon et al., 2007; Ono et al., 2014; Toh et al., 2016).

The results of this analysis are summarized in Table 9, which shows the effect—positive or negative—of each of the interventions to increase the number of physicians practicing in rural areas on the 14 factors for work motivation.

Table 9: Effect of interventions on factors for work motivation

	Intervention type									
	Regulatory		**Financial**		**Educational**			**Tailored**		
	Trickle-down economics	*Coercive measures*	*Targeting student physicians*	*Targeting practicing physicians*	*Selective admission*	*Curriculum changes*	*Rural medical schools*	*Community support*	*Professional support*	*Non-traditional services delivery*
Intrinsic factors										
Achievement			+	+	+		+			
Recognition				+	+			+		
The work itself	−	−			+	+	+		+	+
Responsibility		−				+	+	+	+	
Advancement					+					
Personal growth	−	−	+	+		+	+			
Extrinsic factors										
Administrative policies		−		+	+	+		+	+	
Supervision					+	+	+			
Interpersonal relationships					+	+	+	+	+	+
Work conditions				+			+	+		+
Salary			+	+						
Status							+			

Security	−									
Personal life		−							+	+

5.3.7 Discussion

A logic analysis reveals that the interventions that have been implemented across OECD member countries can plausibly influence a physician's choice of practice location in favor of rural regions, but according to theories of work motivation, not all of the interventions can instill motivation in physicians for the practice of rural medicine. Regulatory interventions employ extrinsic disincentives to dissuade physicians from establishing practice in urban areas. However, regulatory interventions have also been shown to have a negative impact on motivation. Physicians may choose to practice in rural regions, but this is what Herzberg describes as *movement*, not *motivation* (Herzberg, 1968). Physicians are demotivated towards the work. The functional mechanism of each intervention strategy is summarized in Table 10.

According to the two-factor theory, financial incentives are extrinsic in nature, so they cannot motivate physicians, but as Herzberg suggests, financial incentives do result in *movement*. The success of financial interventions may be attributed to their ability to remove sources of dissatisfaction with rural medical practice, and their lack of long-term success may be attributed to their inability to instill motivation in those physicians who may accept temporary rural placements, but will choose urban practice in the long-term. A systematic review of interventions to increase the proportion of health professionals in rural and underserved areas reports that financial incentives showed the highest physician recruitment and retention rates in a US study, but that the long-term benefit of these interventions requires further investigation (Grobler et al., 2009). These results are in line with the basic premise of two-factor theory, yet logic analysis allows for a finer interpretation. We have demonstrated the mechanisms by which financial

interventions can give physicians a sense of achievement and recognition for their work, and can provide opportunities for personal growth on the job. We qualify this by adding that financial interventions are more likely to motivate physicians when they go beyond "strict reward contingencies" (Herzberg, 1968; Herzberg et al., 1959). A simpler approach based on logic analysis would be to administer financial interventions in ways that are more "motivational," in that they would enhance a physician's sense of achievement, recognize the physician, and present opportunities for personal growth in rural medicine, such as professional advancement or skills enhancement. Bonded service agreements that target medical students can be successful because incentives are offered in return for rural internships or rotations. Premiums for rural physicians can be motivational if they cover the costs of continuing medical education or the hiring of support staff. Evidence suggests that the public recognition of rural health workers is a vital measure to improve intrinsic motivation; it can raise the status of rural medicine and boost the morale of physicians, contributing to their retention in rural regions (World Health Organization, 2010). Financial interventions may also be combined with educational or professional support strategies to form "bundled" or "multidimensional" interventions, which have demonstrated the most positive outcomes (Buykx et al., 2010; Dolea et al., 2010; Grobler et al., 2009).

Table 10: Functional mechanism of interventions based on two-factor theory

	Functional mechanism
Regulatory Interventions	
Trickle down economics	Extrinsic disincentives + intrinsic demotivators
Coercive measures	Extrinsic disincentives + intrinsic demotivators
Financial Interventions	
Target medical students	Extrinsic incentives + intrinsic motivators
Target practicing physicians	Extrinsic incentives + intrinsic motivators
Educational Interventions	
Selective admission policies	Intrinsic motivators + extrinsic incentives
Curriculum changes	Intrinsic motivators + extrinsic incentives
Rural medical schools	Intrinsic motivators + extrinsic incentives
Tailored Interventions	
Community support	Extrinsic incentives + intrinsic motivators
Professional support	Extrinsic incentives + intrinsic motivators
Non-traditional services delivery	Extrinsic incentives + intrinsic motivators

Logic analysis demonstrates that educational strategies are the only interventions whose primary aim is to manipulate an individual's "rural inclination," or in other words, to instill motivation for rural life and work within the individual. Strategies such as *selective admission policies*, *curriculum changes*, and *rural medical schools* can motivate physicians for rural medical practice through activities that are shown to alter the job content of rural medical practice, and sometimes the nature of the work itself. Establishing medical schools in rural regions and employing selective admission policies can be the most effective strategies for motivating physicians to practice medicine in rural regions, because they function through four out of the six factors influencing work motivation. Educational interventions also remove a number of the sources of dissatisfaction associated with rural medicine by altering the extrinsic factors for work motivation as outlined by the two-factor theory (Herzberg et al., 1959).

Tailored interventions are similar to financial interventions in that they mostly address extrinsic factors. They remove sources of dissatisfaction with rural medicine, thereby improving work conditions, interpersonal relationships in the workplace, and a physician's personal life. It has been demonstrated that community support measures can also have a positive effect on intrinsic motivation because they can be perceived as acts of recognition of the rural physician, and can help instill a sense of responsibility towards the rural community. Professional support strategies improve the physicians' ability to meet the responsibilities of rural practice, and can change the nature of rural medicine from what was traditionally a solitary career to one where physicians work in group practices, or as part of a network of health professionals. Non-traditional health services delivery strategies eliminate the need for physicians to remain

permanently in remote regions, with temporary remote clinics and telehealth networks changing the practice of rural medicine.

The importance of these results is their relevance to policy planning and evaluation of interventions targeting physician shortages in rural regions. If the purpose of the intervention is to motivate physicians for rural practice, then educational interventions are most effective. Financial interventions are effective in moving physicians to choose rural practice, and if they are designed correctly, with educational or support components, for example, they may instill motivation for rural medicine. Tailored interventions stimulate movement as well, and can also instill motivation. Regulatory interventions force physicians to choose rural practice, and are demotivating. If the intervention strategies chosen for implementation are entirely demotivating, then no improvement will be observed to physician shortages in rural regions, and the problem will persist. If the chosen strategies for intervention are not implemented in a manner that fosters motivation for rural medicine, then the retention of physicians is unlikely. Recruitment is more likely if interventions improve upon the work context, thereby inducing movement. But without retention, interventions will need to be implemented repetitively in order to continually recruit new physicians to rural regions, and shortages will seemingly persist.

This is the first study to evaluate the theory underlying the interventions that have been implemented in OECD countries to increase the number of physicians practicing in rural regions, and therefore, it fills an important gap that has been identified in the literature (OECD, 2008; Ono et al., 2014; World Health Organization, 2010). Similar studies have analyzed physician shortages from the perspective of motivation theories, but no studies were identified that analyze

the interventions to address the shortages from a theoretical perspective. A study by (Campbell, McAllister, & Eley, 2012) use Herzberg's two-factor theory to conduct a literature review on the influence of motivation on the recruitment and retention of rural and remote allied health professionals. The study concludes that negative disincentives, like professional isolation and insufficient supervision, are important causes of physician shortages, and that these can be mediated by intrinsic incentives, such as autonomy and community connectedness. An extensive study by (Franco, Bennett, & Kanfer, 2002) examines the individual, organizational, and societal determinants of health worker motivation, and presents a conceptual model that details how it is affected by health sector reform. Finally, (Hancock et al., 2009) propose four pathways by which rural exposure can facilitate future rural practice; one of these is self-actualization, which is the sequential striving at work to satisfy increasingly complex desires, as described in Maslow's hierarchy of needs.

The limitation of this study is the extent to which the results can be replicated in a specific context. In return for a broad scope of analysis of interventions, a level of detail in describing specific interventions is reduced. We analyze the interventions that have been implemented in OECD countries as a whole. Details regarding the specific operations and processes involved in individual interventions are necessary to determine whether the activities of the intervention positively or negatively affect the factors for intrinsic and extrinsic work motivation. The three steps of logic analysis can be repeated for specific interventions within their contexts to gain a more detailed, and more accurate, account of individual interventions.

Another limitation of this study relates to the controversial elements of work motivation theories in general, and two-factor theory specifically. Questions surrounding the additivity of extrinsic factors and their negative interaction with intrinsic factors limit our ability to prioritize the interventions based on a quantitative measure of motivating factors.

5.3.8 Conclusion

Logic analysis has demonstrated that motivating physicians to choose rural medical practice can best be accomplished through educational interventions, which also remove many of the sources of dissatisfaction with rural practice. Financial interventions are most motivational when they contain educational or support components, but direct payments mitigate important sources of dissatisfaction with rural practice, particularly those related to the work context and external environment. Tailored interventions also function by removing barriers to rural practice or improving the work context, and are changing the nature of rural practice for the better, which can motivate more physicians to choose rural practice. Regulatory interventions cannot motivate physicians to choose rural practice, and they increase dissatisfaction with the profession. The reported "lack of success" in resolving physician shortages need not be attributed to the theoretical weakness of the interventions, which have been shown to have potential for effectiveness in motivating physicians to choose rural regions. The question is in choosing the extent of intervention, the appropriate combination of strategies (depending on the regional context), and the available resources.

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CHAPTER 6: General discussion

The purpose of this research is to understand the persistence of physician shortages in rural regions of OECD countries, despite the implementation of interventions to address the geographic maldistribution. A preliminary literature review reveals two areas of weakness that have been attributed to the interventions: the first is that they do not match the reasons why physicians choose urban practice locations over rural ones, and the second is that the interventions are theoretically unfounded {Ono, 2014 #359;World Health Organization, 2010 #281}. We therefore set out to examine these areas, first by understanding the interventions that have been implemented across OECD countries, and second, by understanding the causes of physician shortages in rural regions. Then, an analysis of the ability of the interventions to address the causes of physician shortages is completed, using strategic analysis. Finally, a logic analysis is employed to examine the theoretical foundation of the interventions.

A total of ten intervention strategies have been employed, alone or in combination, in most OECD member countries. These strategies are generally classified in the reviewed literature as regulatory interventions, financial interventions, educational interventions, and tailored interventions. **Regulatory interventions** take the form of strategies based on *trickle-down economics*, or they can be *coercive measures*. **Financial interventions** *target medical students*, or they can *target practicing physicians*. **Educational interventions** take the form of *selective admission policies*, *curriculum changes*, or establishing *rural medical schools*. **Tailored interventions** include *community support* strategies, *professional support* strategies, or

non-traditional services delivery methods. A description of each of the ten intervention strategies is presented in Table 11.

Table 11: A description of the interventions to reduce physician shortages in rural regions

	Description
Regulatory Interventions	
Trickle-down economics	Oversupplying the market with physicians
Coercive measures	Restricting or mandating location of medical practice
Financial Interventions	
Target medical students	Monetary incentives in return for rural practice
Target practicing physicians	Monetary rewards and incentives for rural practice
Educational Interventions	
Selective admission policies	Recruiting medical students of rural origin, experience or interest
Curriculum changes	Rural content, rotations, internships or specialties
Rural medical schools	Establishing campuses or training sites in rural regions
Tailored Interventions	
Community support	Mobilizing community members and services to assist local physicians
Professional support	Facilitating professional collaboration and development
Non-traditional services delivery	Outreach clinics and telehealth initiatives

Our research shows us that studies that document the interventions are mostly descriptive in nature, with few examples of evaluative studies or research that documents the interventions in a manner that would allow evaluation. Systematic reviews of interventions to reduce physician shortages in rural regions conclude that no single intervention can be said to reduce physician shortages, and that the effectiveness of interventions on the recruitment and retention of rural physicians cannot be determined (Buykx et al., 2010; Grobler et al., 2009).

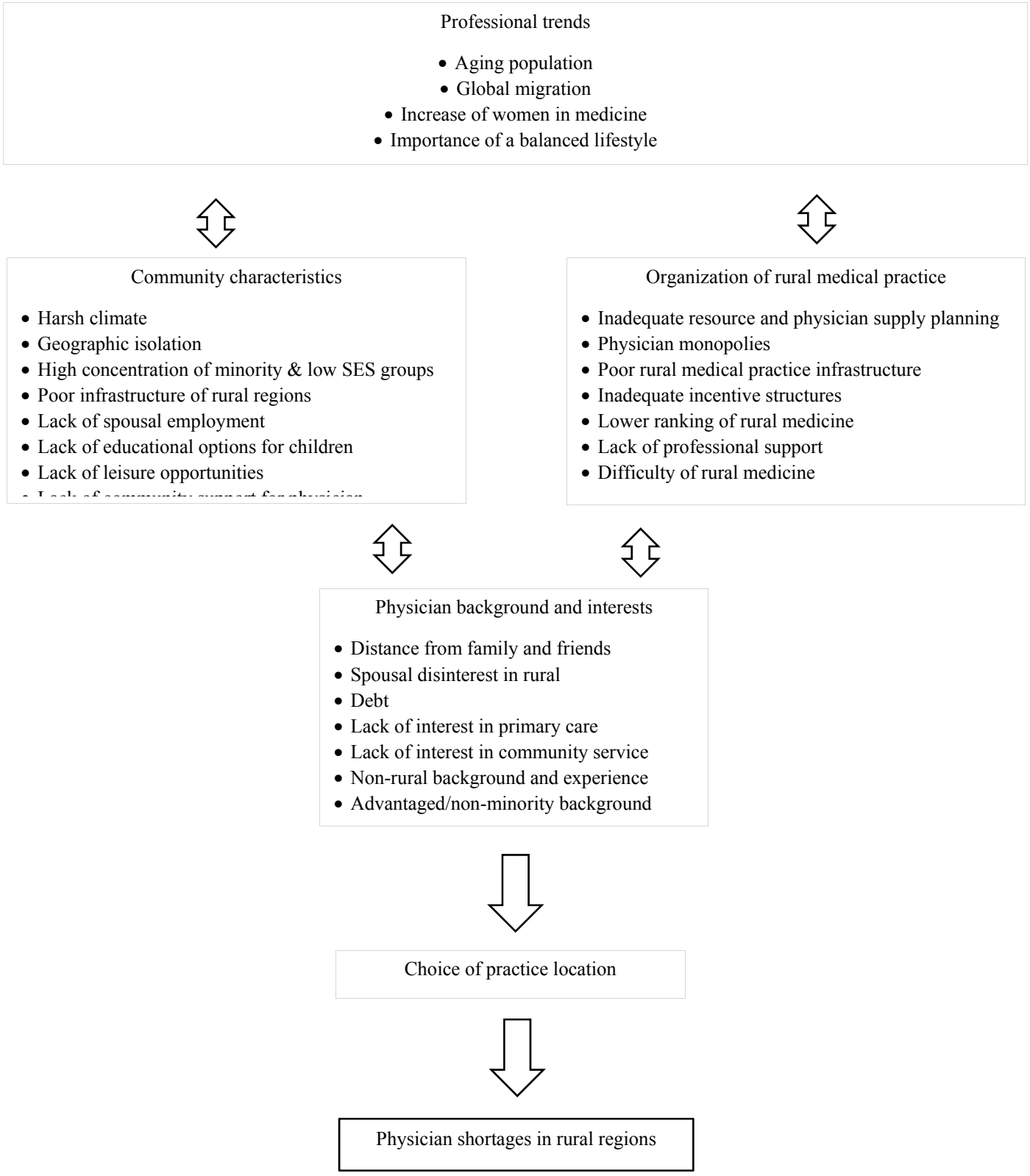
This research identifies a number of strategies that have demonstrated positive outcomes in the literature. All of the strategies are implemented in Canada, Australia, or the US, except for one example each from Norway and Japan. Notable among these are four intervention programs that combine a number of strategies simultaneously: Ontario's Underserviced Area Program in Canada, Australia's Parallel Rural Community Curriculum at Flinders University, Pennsylvania's Physician Shortage Area Program at Jefferson Medical College in the United States, and Japan's Jichi Medical University. These intervention programs all employ a combination of educational strategies, using the "rural pipeline" approach, which favors early and continual intervention in a student's career. Jichi additionally uses financial incentives targeting medical students. Studies suggest that multidimensional programs, ones that combine or "bundle" interventions, are the most effective in getting physicians to practice in rural areas (Buykx et al., 2010; Dolea et al., 2010; OECD, 2008; Ono et al., 2014; Sempowski, 2004; Wilson et al., 2009; World Health Organization, 2010). A description of these interventions, and evidence of their effectiveness, are presented in Table 12. The outcome of each of these interventions is not sufficient to draw causal inference, but based on our analysis, these are the best available examples of intervention programs.

Table 12: Combined intervention programs reporting positive outcomes

Name of program	Country	Strategies employed	Published outcomes
Ontario Underserviced Area Program	Canada	*Selective admission* *Curriculum changes* *Rural medical schools*	70% of graduates are training in family medicine in rural regions (Ono 2014).
Parallel Rural Community Curriculum, Flinders University	Australia	*Selective admission* *Curriculum changes* *Rural medical schools*	Participants' academic performance improved compared to tertiary hospital peers, and compared to their own results in previous years (WHO 2010; Worley 2000). Quota students undertook longer rural placements than their non-quota peers, and were 10 times more likely to spend their intern year in a rural region (Wilson 2009).
Physician Shortage Area Program, Jefferson Medical College	US	*Selective admission* *Curriculum changes*	PSAP graduates represent only 1% of all medical graduates in the State of Pennsylvania, but account for 21% of family physicians practicing in rural Pennsylvania (Rabinowitz 1999). Two-thirds of graduates continued to practice in the same rural area 11–16 years later (Dolea 2010).
Jichi Medical University	Japan	*Financial targeting students* *Selective admission* *Curriculum changes* *Rural medical schools*	Approximately 70% of program graduates were still practicing in a rural region, six years later (Dolea 2010). Graduates are four times more likely to work in rural areas after contractual obligation (Matsumoto 2008).

An examination of the determinants of physician practice location leads to the identification and categorization of 26 causes of physician shortages in rural regions, 19 of which are considered "contextual" causes, while the remaining seven causes are specific to the "individual" *physician's background, experience, and interest*. The 19 contextual causes were further categorized into three subcategories: *professional trends*, *community characteristics*, and the *organization of rural medical practice*. These findings suggest that when intervention policies are guided by a behavioral science framework, they may overlook important contributing factors to the problem of physician shortages. This is because behavior is shaped and regulated by the social context, a guiding principle that has gained increasing traction in the fields of public health and epidemiology (D. A. Cohen et al., 2000; Glass & McAtee, 2006; McLaren & Hawe, 2005; Phelan, Link, & Tehranifar, 2010; Satcher & Higginbotham, 2008). A physician's choice of practice location is a behavior that results from the interaction of 26 causes, ranging from the individual's personal background and interests, all the way to the pervasive effects of large-scale professional trends. This is reflected in Figure 8, a multi-level conceptual framework for the causes of physician shortages in rural regions. This framework shows the interaction between the macro, meso, and micro level causes of physician shortages, which influence a physician's choice of practice location in favor of urban areas, ultimately leading to physician shortages in rural areas.

Figure 8: Multilevel conceptual framework for the causes of physician shortages in rural regions of OECD countries



Further investigation is required to understand the interaction between the causes of physician shortages. Causal analysis allows for the development of causal chains, described as several plausible sequences of cause and effect, extending between the macro and micro levels. Causal analysis would shed further light on the direction and mechanism of influence between the causes of physician shortages. This would also help to identify the "root causes" of physician shortages; causes that figure in several—or all—of the causal chains.

Strategic analysis is an approach to program evaluation that rests on two important principles. The first is that interventions must target the causes of a problem in order to achieve their objectives. The second is that the causes of a problem are not equal; some contribute more greatly than others. Using strategic analysis, the causes of physician shortages are prioritized into four levels, based on a composite score of their importance, their severity, and their solvability. Priority level 1 and 2 causes are priority areas for intervention; the strength of the evidence pointing to the importance of these causes, to their influence on other causes, and to their susceptibility to solution is greatest. Levels 3 and 4 causes are priority areas for research; less is known about them, or about how to solve them. The results of this exercise are presented in Table 13, which also displays the overall rank, category, and thematic classification of each of the causes.

Table 13: Prioritization of the causes of physician shortages in rural regions

Priority Level	Cause of physician shortages	Category	Thematic classification
1	Non-rural background and experience	Individual	Physician background and interest
	Lack of professional support for rural physicians	Contextual	Organization of rural medical practice
	Poor infrastructure of rural regions	Contextual	Community characteristics
	Lack of interest or experience in primary care	Individual	Physician background and interest
	Poor rural medical practice infrastructure	Contextual	Organization of rural medical practice
2	Inadequate incentive structures	Contextual	Organization of rural medical practice
	Difficulty of rural medicine	Contextual	Organization of rural medical practice
	Lack of community support for physicians	Contextual	Community characteristics
	Lower ranking of rural medicine	Contextual	Organization of rural medical practice
	Lack of spousal employment	Individual	Physician background and interest
3	Lack of educational options for children	Individual	Community characteristics
	Lack of leisure opportunities	Contextual	Community characteristics
	Lack of community service orientation	Individual	Physician background and interest
	Distance from extended family & friends	Individual	Physician background and interest
	High concentration of minority & low SES groups	Contextual	Community characteristics
	Harsh climate	Contextual	Community characteristics
	Importance of a balanced lifestyle	Contextual	Professional trends
	Inadequate health resources and physician supply planning	Contextual	Organization of rural medical practice

4	Debt	Individual	Physician background and interest
	Spousal non-rural background or disinterest in rural life	Individual	Physician background and interest
	Global migration	Contextual	Professional trends
	Aging population	Contextual	Professional trends
	Increase of women in medicine	Contextual	Professional trends
	Geographic isolation	Contextual	Community characteristics
	Advantaged/non-minority background	Individual	Physician background and interest
	Physician monopolies	Contextual	Organization of rural medical practice

It is shown in Table 13 that priority levels 1 and 2 causes of physician shortages are a mix of individual and contextual, but are all related either to *physician background and interest*, the *organization of rural medicine*, or to *community characteristics*. *Professional trends* are prioritized as level 3 or 4. These are "higher order" contextual causes—macro level causes—that may have traditionally been outside of the disciplinary scope of investigation into the geographic maldistribution of physicians, or that may be have been considered "unsolvable." Further research is required to understand these causes of physician shortages and how they can influence a physician's ultimate choice of practice location.

The second step of strategic analysis allows us to prioritize the interventions based on their ability to target the causes of physician shortages. This is displayed in Table 14, which shows that *rural medical schools* target the greatest number of causes, including all of the priority level 1 causes. Rural medical schools also target the causes across levels: three community characteristics, four organizational characteristics, and three individual

characteristics. Strategic analysis demonstrates that the strength of rural medical schools is not just in the number of problems they can potentially solve, but also in the nature of these problems. By targeting both individual and contextual-level causes of physician shortages, those related to the organization of rural medical practice, and those related to community characteristics, rural medical schools have a wider reach than other intervention strategies. By intervening across and within levels, rural medical schools can potentially reduce the number of causal chains resulting in the rejection of rural medicine by physicians.

Table 14: Ranking of the interventions by targeted causes

	Causes targeted	Priority	Thematic classification	Category
Rural medical schools	Geographic isolation	4	Community characteristics	Contextual
	Poor infrastructure of rural regions	1	Community characteristics	Contextual
	Lack of community support for physician	2	Community characteristics	Contextual
	Poor rural medical practice infrastructure	1	Organization of rural medical practice	Contextual
	Lower ranking of rural medicine	2	Organization of rural medical practice	Contextual
	Lack of professional support for physicians	1	Organization of rural medical practice	Contextual
	Difficulty of rural medicine	2	Organization of rural medical practice	Contextual
	Lack of interest in primary care	1	Physician background and interests	Individual
	Lack of interest in community service	3	Physician background and interests	Individual

	Non-rural background and experience	1	Physician background and interests	Individual
Target practicing physicians	Poor rural medical practice infrastructure	1	Organization of rural medical practice	Contextual
	Inadequate incentive structures	2	Organization of rural medical practice	Contextual
	Lower ranking of rural medicine	2	Organization of rural medical practice	Contextual
	Lack of professional support for physicians	1	Organization of rural medical practice	Contextual
	Difficulty of rural medicine	2	Organization of rural medical practice	Contextual
	Distance from family and friends	3	Physician background and interests	Individual
	Debt	3	Physician background and interests	Individual
	Lack of interest in primary care	1	Physician background and interests	Individual
	Non-rural background and experience	1	Physician background and interests	Individual
Non-traditional services delivery	Geographic isolation	4	Community characteristics	Contextual
	Aging population	4	Community characteristics	Contextual
	High concentration of minority & low SES groups	3	Community characteristics	Contextual
	Poor infrastructure of rural regions	1	Community characteristics	Contextual
	Lack of community support for physician	2	Organization of rural medical practice	Contextual
	Poor rural medical practice infrastructure	1	Organization of rural medical practice	Contextual

	Lack of professional support for physicians	1	Organization of rural medical practice	Contextual
	Difficulty of rural medicine	2	Organization of rural medical practice	Contextual
Curriculum changes	Lower ranking of rural medicine	2	Organization of rural medical practice	Contextual
	Lack of professional support for physicians	1	Organization of rural medical practice	Contextual
	Difficulty of rural medicine	2	Organization of rural medical practice	Contextual
	Lack of interest in primary care	1	Physician background and interests	Individual
	Lack of interest in community service	3	Physician background and interests	Individual
	Non-rural background and experience	1	Physician background and interests	Individual
Selective admission policies	High concentration of minority & low SES groups	3	Community characteristics	Contextual
	Lack of interest in primary care	1	Physician background and interests	Individual
	Lack of interest in community service	3	Physician background and interests	Individual
	Non-rural background and experience	1	Physician background and interests	Individual
	Advantaged/non-minority background	4	Physician background and interests	Individual
Coercive measures	Lack of professional support for physicians	1	Organization of rural medical practice	Contextual
	Lack of interest in community service	3	Physician background and interests	Individual
	Lack of interest in primary care	1	Physician background and interests	Individual

	Non-rural background and experience	1	Physician background and interests	Individual
Target medical students	Lower ranking of rural medicine	2	Organization of rural medical practice	Contextual
	Debt	3	Physician background and interests	Individual
	Lack of interest in primary care	1	Physician background and interests	Individual
	Non-rural background and experience	1	Physician background and interests	Individual
Professional support	Poor rural medical practice infrastructure	1	Organization of rural medical practice	Contextual
	Difficulty of rural medicine	2	Organization of rural medical practice	Contextual
	Lack of professional support for physicians	1	Organization of rural medical practice	Contextual
Community support	Lack of community support for physician	2	Community characteristics	Contextual
	Lack of spousal employment	4	Community characteristics	Contextual
	Difficulty of rural medicine	2	Organization of rural medical practice	Contextual
Trickle-down economics	NONE			

Targeting practicing physicians targets one fewer causes than rural medical schools, but none of these are related to community characteristics; financial incentives to rural physicians have not been shown to improve upon the context of the rural community. They target the individual and organizational causes of physician shortages that can be mitigated through monetary means; they get physicians to rural regions, potentially stimulating their interest, and always giving them rural experience, the lack of which is the number one cause of physician shortages in rural regions.

It is also important to note that this strategy may not target all of the nine causes at once, because not all physicians will receive every financial incentive that is studied in this research. For example, a rural physician may potentially receive an installation premium, a higher salary than an urban counterpart, grants for CME, travel stipends, or allowances to hire support staff, but not necessarily all of these incentives, and not all of the time. Financial incentives targeting physicians are strongest when they are multifaceted. Establishing a campus in a rural area will likely target all 10 of the causes of physician shortages, possibly simultaneously, including reducing the geographic isolation of the rural area, improving upon rural infrastructure and the organization of medical practice, and making rural medical practice more interesting for individuals.

Non-traditional services delivery is ranked third in terms of effectiveness of targeting the causes of physician shortages, an interesting finding since outreach clinics and telemedicine are rarely studied as interventions, and recommendations for tailored interventions usually refer to

community and professional support measures (Dolea et al., 2010; Wilson et al., 2009). This strategy does not target individual causes of physician shortages: those related to background, interest, and experience. Instead, the focus is on meso-level contextual causes: those characteristics of the rural community— or of the way medical service delivery is organized in a particular rural region—that inhibit physicians from settling those regions permanently.

Curriculum changes target more causes than *selective admission policies*, and those causes are both individual and contextual; they are related to the organization of rural medical practice, and thus have a wider reach. *Selective admission policies* target exclusively individual-level causes, except when specific underrepresented groups are the focus of intervention, then the social context of these communities may also be affected.

Coercive measures target four causes of physician shortages, including three priority level 1 causes: two individual and one contextual cause. They are therefore ranked higher than *targeting medical students*, which also addresses four causes, but only two of which are priority level 1. From this perspective, the advantages of "bonded service agreements" are debt relief and getting students to rural areas, where they will acquire some rural experience and may develop an interest in primary care. When financial incentives to medical students are presented in the form of scholarships or awards, they may serve to elevate the ranking of rural medicine among other specialties. *Coercive measures* may provide professional support for rural physicians by obligating other physicians to practice in their region. They may also function in the same manner as financial incentives targeting medical students in that they get physicians to rural

areas, where they will acquire rural experience and may develop an interest in primary care and community service. However, we suggest that the forced nature of this strategy impedes its ability to foster interest in the rural.

Finally, Table 14 demonstrates that professional and community support strategies are ranked last, because they each target only three causes of physician shortages, all of which are contextual. Professional support strategies directly address the lack of professional support and are able to mitigate the poor rural medical practice infrastructure, both priority level 1 causes. Community support strategies address level 2 causes and may sometimes assist with spousal employment, a level 4 cause of physician shortages. The regulatory strategy of *trickle-down economics* has not been shown to target any of the causes of physician shortages in rural regions.

A logic analysis brings a different perspective to the interventions implemented in OECD countries to address the geographic maldistribution of physicians. Instead of examining whether and how interventions target the causes of physician shortages in rural regions, logic analysis examines whether the interventions have any basis in scientific theory, and how this theory determines the interventions' functional mechanism. Our research shows us that interventions are anchored in a human resources management approach, which seeks to understand the motivation behind a physician's choice of practice location. Research into theories of work motivation, with an emphasis on Frederik Herzberg's two-factor theory, leads to the understanding that motivation helps to predict workplace behavior, as well as the effort and the persistence that people put into their actions at work (Ambrose & Kulik, 1999; Gagne & Deci, 2005; Grant &

Shin, 2011; Johns, 2006; Latham & Pinder, 2005) . If this action is the choice of practice location, then physicians who are motivated for rural medical practice will put effort into rural medicine, and will persist at this choice. Two-factor theory posits that there are two types of work motivation, extrinsic and intrinsic. Extrinsic motivation is related to the job context, while intrinsic motivation is related to the job content. Extrinsic motivators include seven factors related to the work environment: the *administrative policies* in the workplace, *supervision*, *interpersonal relationships*, *work conditions*, *salary*, *status*, and aspects affecting *personal life*. Intrinsic motivators are represented by six factors related to the work content: *achievement*, *recognition*, *the work itself*, *responsibility*, *advancement*, and *personal growth*. True motivation is the result of intrinsic factors, while extrinsic factors can only result in movement, described as behaviors driven by the satisfaction of biological needs and pain avoidance, rather than by the ability to achieve and to experience psychological growth (Herzberg et al., 1959).

Interventions to reduce physician shortages in rural regions can be either extrinsic or intrinsic in nature, and depending on their nature, they will either move/recruit physicians to rural regions, or will motivate/retain physicians to rural regions. Long-term retention is the result of motivation for the job, which is a result of intrinsic motivation and the job content, rather than the external work environment. Based on this understanding of the theories of work motivation, anchored in Herzberg's two-factor theory, a logic model is proposed for each of the interventions that depicts how each intervention to reduce physician shortages is meant to work. In Table 15, the interventions are listed along with a description of their functional mechanism and the anticipated result of the intervention. **Regulatory** interventions are considered a form of extrinsic *disincentive*, which implies the use of external tools related to the work environment rather than

to the actual work of rural medical practice. These tools are used as a form of discouragement, rather than an incentive to rural work. The fear of negative repercussions drives physicians to choose rural medical practice. **Financial** interventions use extrinsic incentives to encourage physicians to choose rural medicine and will therefore result in the movement, or in other words, the recruitment, of physicians. **Educational** interventions can alter an individual's perception of rural medicine through targeted education and training, and are therefore the only strategies that are considered intrinsic motivators—ones that can potentially result in physician motivation and retention to rural regions. **Tailored** interventions employ the use of extrinsic incentives in the form of improvements to the work context, community support, professional support, or health services delivery methods that do not require permanent presence in the rural region. These interventions can help with the movement/recruitment of physicians to rural regions.

Table 15: Functional mechanism of interventions and their anticipated results

	Functional mechanism	Description	Anticipated result
Regulatory Interventions			
Trickle-down economics	Extrinsic disincentives	Threat of unemployment due to increased competition in urban areas	Movement/recruitment
Coercive measures	Extrinsic disincentives	Penalties for not practicing in rural regions	Movement/recruitment
Financial Interventions			
Target medical students	Extrinsic incentives	Payment in exchange for rural practice	Movement/recruitment
Target practicing physicians	Extrinsic incentives	Payment in exchange for rural practice	Movement/recruitment
Educational Interventions			
Selective admission policies	Intrinsic motivators	Medical education for the rurally inclined	Motivation/retention
Curriculum changes	Intrinsic motivators	Rural medical education and training components	Motivation/retention
Rural medical schools	Intrinsic motivators	Rural medical education and training on location	Motivation/retention
Tailored Interventions			
Community support	Extrinsic incentives	Activities to facilitate physician and family integration into the community	Movement/recruitment
Professional support	Extrinsic incentives	Facilitate professional networks and group practice	Movement/recruitment
Non-traditional services delivery	Extrinsic incentives	Outreach clinics and telehealth	Movement/recruitment

A logic analysis of the interventions' functional mechanism, within the theories of work motivation, demonstrates that each intervention strategy can potentially affect both extrinsic and intrinsic factors for work motivation, regardless of the primary functional mechanism, as depicted in Table 15. Logic analysis allowed us to add nuance to the understanding of the functional mechanism of the various intervention strategies. Theories for work motivation lead us to determine that among the intervention strategies implemented in OECD countries, educational interventions and *rural medical schools*, followed by *selective admissions policies* and *curriculum changes*, have the greatest potential to motivate physicians to choose rural medicine. The ranking of the interventions based on the number of targeted factors for work motivation is presented in Table 16.

Table 16: Ranking of the interventions by motivational type

Strategy	Factors for work motivation	Type
Rural medical schools	Achievement	Intrinsic
	The work itself	Intrinsic
	Responsibility	Intrinsic
	Personal growth	Intrinsic
	Supervision	Extrinsic
	Interpersonal relationships	Extrinsic
	Work conditions	Extrinsic
	Status	Extrinsic
Selective admission policies	Achievement	Intrinsic
	Recognition	Intrinsic
	The work itself	Intrinsic
	Advancement	Intrinsic
	Administrative policy	Extrinsic
	Supervision	Extrinsic
	Interpersonal relationships	Extrinsic
Curriculum changes	The work itself	Intrinsic
	Responsibility	Intrinsic
	Personal growth	Intrinsic
	Administrative policy	Extrinsic
	Supervision	Extrinsic
	Interpersonal relationships	Extrinsic
Target practicing physicians	Achievement	Intrinsic

	Recognition	Intrinsic
	Personal growth	Intrinsic
	Work conditions	Extrinsic
	Administrative policy	Extrinsic
	Salary	Extrinsic
Professional support	The work itself	Intrinsic
	Responsibility	Intrinsic
	Administrative policy	Extrinsic
	Interpersonal relationships	Extrinsic
	Personal life	Extrinsic
Community support	Recognition	Intrinsic
	Responsibility	Intrinsic
	Administrative policy	Extrinsic
	Interpersonal relationships	Extrinsic
	Work conditions	Extrinsic
Target medical students	Achievement	Intrinsic
	Personal growth	Intrinsic
	Salary	Extrinsic
Non-traditional services delivery	The work itself	Intrinsic
	Interpersonal relationships	Extrinsic
	Work conditions	Extrinsic
	Personal life	Extrinsic
Trickle-down economics	The work itself	Negative intrinsic
	Personal growth	Negative intrinsic

	Job security	Negative extrinsic
Coercive measures	The work itself	Negative intrinsic
	Responsibility	Negative intrinsic
	Personal growth	Negative intrinsic
	Administrative policy	Negative extrinsic
	Personal life	Negative extrinsic

Educational strategies are considered intrinsic motivators by nature because they target cognitive and psychological development. They are also characterized by a selection bias; those who apply to rural medical schools or accept selective admissions policies are arguably already motivated to become rural physicians. This is not always the case, though. Some rural medical schools are also involved in recruitment activities that target students who may not have otherwise considered a career in medicine (Curran et al., 2004; Pong & Heng, 2005). Regardless, educational policies target the greatest number of intrinsic factors for work motivation, so are most likely to motivate physicians to choose rural medicine. They also target the most extrinsic factors for work motivation, but Herzberg cautions against tallying extrinsic factors; they are not additive, and they may interact negatively with each other and with any intrinsic factors that are present (Gagne & Deci, 2005; Ryan & Deci, 2000; Sachau, 2007). We are not able to comment on the interaction between the factors, nor on the direction or magnitude of this interaction.

Curriculum changes and *targeting practicing physicians* are strategies that target an equal number of intrinsic and extrinsic factors, but educational interventions are ranked higher because of their primarily intrinsic functional mechanism. Financial interventions are extrinsic in nature, but if incentives are presented to practicing physicians in the form of awards—grants for continuing education and skills enhancement, for example—then they also have the capacity to foster intrinsic motivation for rural medicine. *Professional* and *community support* strategies also target equal numbers of intrinsic and extrinsic factors, and are ranked equally. Financial interventions *targeting medical students* have less motivating power than *targeting practicing physicians*. This is due to the variety and the flexibility of the incentives offered to practicing physicians compared to those offered to medical students, who are offered incentives in the form

of loan repayment, or scholarships, in return for rural service upon graduation. As with all of the extrinsic interventions, these strategies have what researchers refer to as an "escalating zero point," which means that human need for extrinsic incentives never ends (Ryan & Deci, 2000; Sachau, 2007). Unlike educational interventions, financial incentives and professional or community support strategies cannot be offered only once. They must be offered continuously throughout the career of the physician. They may also lead to unintended negative results. We have outlined how financial and support strategies could have unintended *positive* results for intrinsic motivation. However, continuous extrinsic incentives may not necessarily add up to positive results for motivation. Some motivation researchers suggest that financial incentives actually undermine interest (and intrinsic motivation) for the work (Ryan & Deci, 2000). *Non-traditional services delivery* are strategies that alter the context of rural medicine, but due to their innovative nature and the ability to tailor these interventions to the specific needs of the target community, they also change the nature of rural work itself.

Finally, regulatory strategies are ranked last in terms of their potential to foster motivation for rural medical practice. *Trickle-down economic* strategies and *coercive measures* are found to use negative disincentives to push physicians to choose rural jobs, and are also found to have negative repercussions for intrinsic motivation. In other words, these strategies are *demotivating*, and may result in the opposite of the intervention's intended result. Participants may develop a disinterest in the rural, and a dislike of rural medical practice.

6.1 Implications for policy

Table 17: Ranking of the interventions by strategic and logic analysis

Strategic analysis	Logic analysis
Rural medical schools	Rural medical schools
Financially targeting practicing physicians	Selective admission policies
Non-traditional services delivery	Curriculum changes
Curriculum changes	Financially targeting practicing physicians
Selective admission policies	Professional support
Financially targeting medical students	Community support
Coercive measures	Financially targeting medical students
Community support	Non-traditional health services delivery
Professional support	Trickle-down economics
Trickle-down economics	Coercive measures

The overall ranking of the interventions to reduce physician shortages in rural regions, based on a strategic and a logic analysis, are presented in Table 17. This study demonstrates that establishing medical schools in rural regions is the best intervention strategy for a sustainable approach to the geographic maldistribution of physicians. Rural medical schools solve many of the most significant problems preventing physicians from choosing rural medicine, and they function in a way that improves upon the context of rural medical practice and instills an intrinsic

motivation for rural medicine among participants. The main disadvantage of establishing rural medical schools relates to the costliness of intervention (Ono et al., 2014).

Strategic and logic analysis demonstrate that the other educational strategies of selective admissions policies and curriculum changes, and the financial strategy of targeting practicing physicians are the next best intervention strategies for reducing physician shortages. Selective admissions policies and curriculum changes may be less costly educational strategies, compared to rural medical schools. Curriculum changes may be preferred to selective admissions policies because they are less likely to illicit controversy, since they do not involve "affirmative action" or ethnic or socioeconomic profiling of students. This study demonstrates that curriculum changes are the most commonly implemented educational strategies among OECD countries. If establishing rural medical schools is too costly, then curriculum changes is the next best educational intervention.

The exact ranking of the interventions differs slightly depending on which evaluative approach is taken, but from a policy perspective, the most appropriate intervention strategy will depend on the specific context in which the intervention will be implemented, and on the exact activities and resources that are dedicated to the interventions. For example, financial interventions targeting practicing physicians rank higher when they are multifaceted, or target several problem areas simultaneously, such as when they contain educational or professional support components, and when they can make up for the opportunity cost of practicing medicine in a rural region.

Overall, educational interventions are recommended, followed by financial interventions targeting practicing physicians, for rural regions of OECD countries experiencing physician shortages.

Non-traditional services delivery and professional support strategies come next in the ranking. Non-traditional services delivery renders many of the causes of physician shortages obsolete, while professional support strategies have the potential to improve how physicians feel about rural medicine and to foster motivation for the work. In this case, again, multi-component non-traditional health services delivery methods and robust professional support strategies are more likely to achieve these positive outcomes than a singular strategy. The production of the intervention strategy, and how it is implemented, will determine its effectiveness.

It is recommended that community support strategies are further developed, and more evidence of successful interventions obtained, prior to implementation. This research demonstrates that financially targeting medical students is one of the least effective approaches to addressing physician shortages in rural regions. Finally, policymakers are dissuaded from employing regulatory interventions to force or coerce physicians to practice rural medicine.

The type of intervention that should be chosen is a question of policy priorities. Is the goal to make sure there is always a continuous stream of physicians to cover shortage areas? Or

is it to ensure that there are always physicians who will be interested in establishing permanent practices in rural regions? If the priority is the first goal, then the emphasis is on recruitment, and financial, professional, and community support strategies may be sufficient, if planned and implemented appropriately. If the priority is the second goal, then educational interventions are most likely to accomplish this goal. Non-traditional services delivery methods are an important and powerful component of any intervention, and further research in this area has the potential to change the face of healthcare services provision to disadvantaged populations.

6.2 Contributions

This study makes a number of contributions to the subject of interventions to increase the number of physicians practicing in rural and remote regions of OECD countries. The main contribution is the confirmation that the persistence of physician shortages in rural regions is not because of the weakness of the theoretical foundations of the interventions designed to solve the problem. The interventions are relevant to the problem at hand, and are designed in a way that can plausibly solve the problem. The persistence of physician shortages is likely due to *how* the interventions are implemented, which is a question of production, and the appropriateness and sufficiency of the activities and resources dedicated to the intervention. For example, (Pathman et al., 2004)suggests that physician shortages in rural regions is due to insufficient recruitment: not recruiting enough physicians into rural medicine, and not recruiting at frequent enough intervals to keep up the supply of physicians to rural regions. If recruitment is done correctly, it could make up for attrition rates, and is an alternative approach to trying to retain the same physicians to rural medical practice. The effectiveness of the intervention is a question that is

subject to an evaluation of implementation, which involves studying the relationship between the volume and the quality of produced services, as well as the resources utilized. This type of evaluation uses assessment criteria such as productivity, quality, accessibility, and continuity (Brousselle & Champagne, 2011).

Another possibility is that the persistence of physician shortages in rural regions is an issue of governance. It may be that the provision of physician services to some rural and remote regions is simply not a top priority for some OECD member countries. If it is a priority, then this study has contributed a useful blueprint to designing appropriate interventions to reduce physician shortages in rural regions.

The theoretical contribution of this thesis is that it furthers understanding of the functional mechanism of interventions to reduce physician shortages. Many of the publications reviewed for this research suggest that educational interventions may be the most effective, but none of these studies offer an explanation based on scientific evidence as to why. We have explained what makes some interventions strong, and what can make others ineffective. This research furthers understanding of how and why health and social services interventions work, in theoretical terms. This is a useful contribution to the evaluation literature, and to the area of theory-based evaluation.

This research offers a methodological framework for evaluative research that is rooted in social science theory, and that is up-to-date with recent developments in public health and in the

organizational sciences. An understanding of health and social phenomena is achieved through a multilevel analysis that examines the interaction of the individual within the greater social context. This thesis offers an approach to evaluation that attempts to operationalize the study of context by way of the tools and techniques commonly used in evaluation and in strategic management, such as prioritization matrices, performance criteria, causal analysis and logic modelling.

6.3 Limitations

This research is a theory-based evaluation of interventions to reduce physician shortages in rural regions. We chose a critical review of published literature, and a theoretical approach to analysis. Two other approaches could have added depth to this research and enhanced the validity of the results. First, an evaluation of a real-life intervention would shed light on some of the specific contextual challenges facing policymakers. Second, interviews with stakeholders involved in this area of policy would shed light on the prioritization of problems and their solutions at the decision-making level. Finally, as strategic analysis is a relatively underdeveloped approach to evaluation, replication and validation of this method would add strength to the results of this study.

CHAPTER 7: Conclusion

The interventions that have been implemented in OECD member countries in order to address the shortages of physicians in rural and remote regions are relevant and plausible. The interventions are designed in a way that attempts to resolve the causes of physician shortages in rural regions. The functional mechanism of the interventions can plausibly motivate physicians to establish practice in rural regions. The persistence of physician shortages in rural regions cannot be attributed to the weakness of intervention design, but may be due to an inadequate implementation of interventions, or to the low priority of intervening to improve physician service provision to rural and remote regions.

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